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Computer Conversation Compared with Human Conversation

Why a *Small* Computer?

Essential Special Terms in Computers and Data Processing

SEPTEMBER
1960
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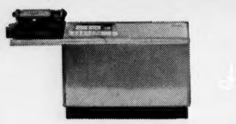
VOL. 9 - NO. 9 & 9B



LGP-30 COMPUTER ABSTRACTS

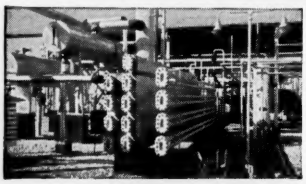
(Application Report #10, from which the following is abstracted, is free upon request from Royal McBee Corporation, Data Processing Division, Port Chester, N.Y.)

Subject: Design / User: Brown Fintube Company, Elyria, Ohio

The Problem: rush quotation for heat exchanger to potential customer. Determine best heat exchanger vs. cost combination. Perform necessary computations to obtain values for total surface area; total number of exchangers; area/exchanger; velocity and pressure drop—shell and tube; film coefficient; log mean temperature difference; overall transfer rate; clean rate; overall fouled rate; surface actually required; duty; price.

Method: the compact, low-cost Royal Precision LGP-30 Electronic Computer.

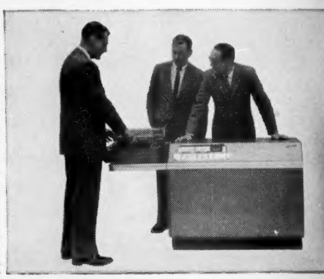
Input Data: except for special specifications which are handled by design engineers, non-technical personnel fill in data directly from customer inquiry sheets. This information is then punched on tape.



Solution: the engineer reads the above data into storage in specifically assigned memory locations on the computer's magnetic drum. The set of program instructions—also stored on the drum—then directs the computer where to find the input data and what mathematical operations to perform in the proper sequential order. The program then further directs the computer to store the various answers in specifically assigned memory locations.

Of notable interest is the incorporated test feature which allows any type and arrangement of sections to be tested by the computer. The program not only compares calculated values, but provides a corrective computation and recomputes all conditions until satisfactory values are obtained. The engineer need only type in the exact arrangement desired to have the computer calculate his proposed arrangement – assuring complete versatility and control over the program.

Output: all numbers required for the final specification sheet, including price, are provided—as well as key intermediate answers to enable the engineer to exercise judgment. The computer automatically controls the typewriter so that all answers are printed out in the desired format.



Conclusions: with the LGP-30, Brown Fintube has reduced total time on typical heat exchanger designs from one or two hours to approximately 3 minutes. Better design vs. cost combinations have been obtained—with a resulting increase in contract awards and the elimination of under-bidding. According to company officials, "perhaps the most significant contribution of the LGP-30 has been the release of engineering manpower for more basic and profound studies."

Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. LGP-30 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For your free copy of Application Report #10, as well as full specifications on the compact, mobile LGP-30, write today to **ROYAL McBEE CORPORATION,** data processing division, Port Chester, N.Y.

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. . . . inserted between pages 16 and 17

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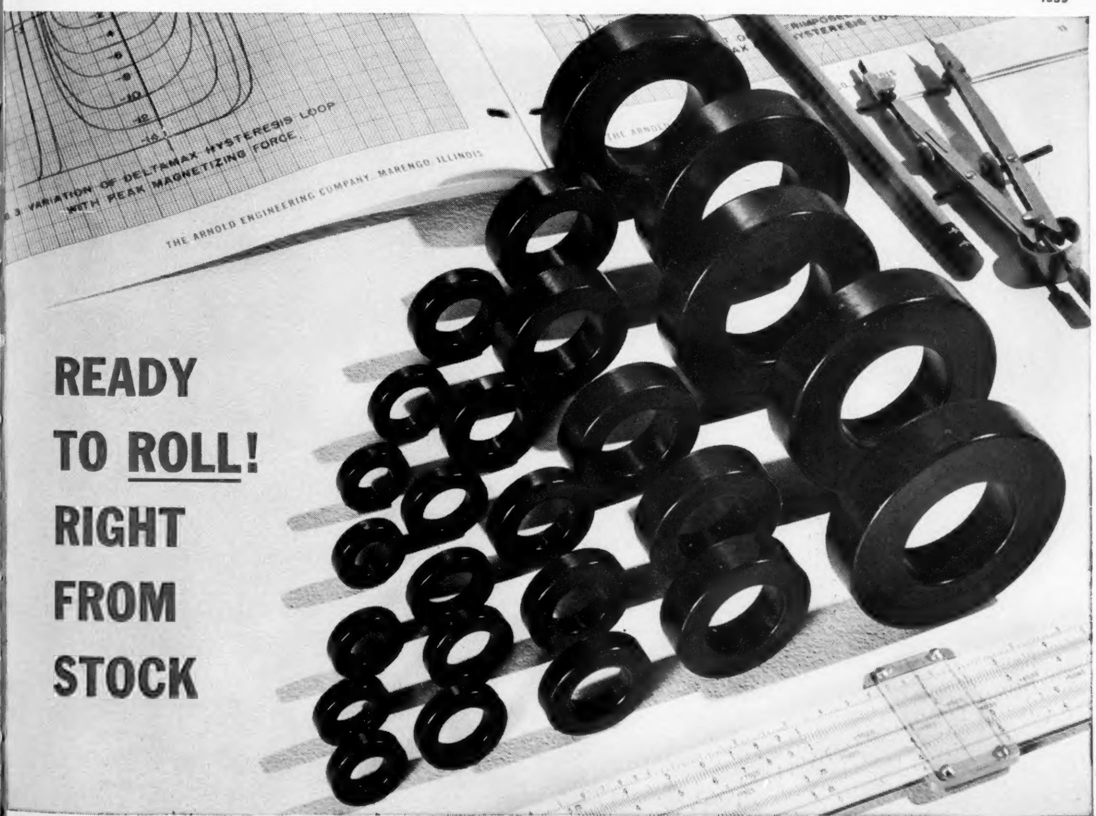


Computer Conversation Compared with Human Conversation

Patrick J. McGovern
Assistant Editor, Computers and Automation

(Based on a thesis in partial fulfilment of the requirements for the degree of Master of Science, at Mass. Inst. of Technology, Cambridge, Mass., May, 1960)

I.

Can a computer think? The answer usually given to this question is expressed in the personal outlook of the person answering to the extent that the word "thinking" has a personal meaning for him.

If he is an intuitionist, and believes that "thinking" means all the emotional vibrations, intellectual nuances, and speculative gestures that he believes he is sometimes conscious of, then he would probably be very reluctant to admit that a piece of machinery, no matter how complex, could duplicate the physiological and psychological events that constructed his mental experiences.

If, on the other hand, he is a behaviorist, and defines "thinking" as those processes that lead an organism, particularly a human being, to perform those actions accepted by others as intelligent behavior, i.e., having some goal in sight that is beneficial to the organism, and having in at least a crude way a systematic pattern of performance, such a person might be willing to admit that a computer was "thinking" if it was able to simulate one of these commonly accepted forms of intelligent behavior.

This latter viewpoint led the famous English mathematician A. M. Turing twenty years ago to suggest that a computer could be said to be capable of thinking if it could carry on a conversation with a human being in another room in such a way that the human being could not tell whether he was conversing with a computer or with another person. Since that time this definition of computer "thinking" has stood as a challenge to computer workers that has not yet been satisfactorily answered.

This paper reports an approach to the satisfactory application of this criterion, presents a program that illustrates this approach, and analyzes the success of this program by a technique analogous to that suggested by Turing.

Characteristics of a Conversation

In examining the problem of conveying meaning in a conversation, we see that there are rules and regulations commonly known as grammar which do not permit a structureless jumble of words to comprise a conversation. Similarly, there is a structure to individual word groups, sequences of word groups, and operations between word groups that enable them to express meaning in a conversation.

Meaning in a conversation is a sequence of thoughts expressed by word groups, or symbol groups comprising a punctuation mark, a word, or a group of words. A thought, as defined here, is identified by:

(1) A key word or pattern of words which expresses the subject at hand.

(2) A modifying word or words which pinpoint what we wish to say about another thought group.

(3) A word or pattern of words which operates on the subject at hand.

(4) A key word or group of words which identifies an object, or the thing operated upon.

(5) A key word or group of words which identifies the modification to the object.

(6) A key word or group of words which identifies spatially and temporally, the modification of the operator thought.

With these thought groups defined, we can approach a working definition of a conversation as: an exchange of thought group sequences between two or more persons during which thought sequences are generated by the meaning of the remark that the person has listened to, the environment in which the remark is made, the knowledge and experience of the person, and the emotional state of the person at the time. The interaction of these four factors is the control mechanism in the generation of conversational statements and replies.

Conversation Type to Be Used By the Computer

Clearly an attempt to program a computer such as the IBM 704 to carry on an intelligent, and responsive conversation with a human being in a wide range of subjects is too complex a task to accomplish immediately. However an effective beginning to the problem can be made by choosing a common everyday topic of conversation and preparing this for machine operation. A reasonable choice is the topic of the weather, for it is an aspect of life about which almost all people have personal knowledge, and have the capacity to conduct conversational thought exchanges. The topic of the weather was chosen for this computer-person conversation program.

Outline of a Complete Programmed Conversation

For a complete programmed conversation the computer must have the following abilities:

(1) Ability to take in the input remark as words.

(2) Ability to convert the input words into a "machine language" which the machine can handle by its logical and arithmetical instructions.

(3) Ability to manipulate the word groups in such a way as to construct an image or representation of their meaning.

(4) Ability to search for, and choose one or more thought groups that are reasonably associated with the input remark.

(5) Ability to arrange the selected thought groups in the appropriate order so that they have a meaning that is pertinent to the input remark and to express them in words, thus forming a reply;

(6) Ability to print out this reply.

The only recorded effort to construct a program for conversation with a computer was presented in an article by L. E. S. Green, E. C. Berkeley, and C. C. Gotlieb in **Computers and Automation** for September, 1959, and in a paper at the Dec. 1959 conference of the A. A. A. S. ([1,8]). This attack on the problem ignored the grammatical implications of the input words, and their relations to thought groups. This approach treated each word as a separate unit, and assigned to each word two numerical constants (q,d) which specified the quality and the degree of each input word according to an arbitrary classification system constructed by the programmer. From the character of the input words they arranged for the machine to select a certain output frame out of a collection; each frame contained blank spaces for the insertion of specific output words. Upon selection of the appropriate reply frame by a successive comparison technique the computer would then consult its output vocabulary dictionary for the output words that would come closest to fitting both the class of input remark and the style of the output frame.

The authors stated that "the present program contains very limited recognition of many parts of English syntax." This they consider to be the major factor in the "crudity" of their results. They leave the problem with the statement that "an unsettled problem is how little additional syntax would have to be included so that the program would plausibly imitate a man."

Aspect of the Conversation Problem Covered in the Present Program

This last remark is the essence of the attack on the problem presented in this investigation.

The features of the present program are:

(1) Each input remark is broken down into thought groups similar to those defined above.

(2) Two numerical constants are assigned to each thought group, one specifying the grammatical character of the thought group, and the other specifying the quality or type of thought group with reference to a certain classification system.

(3) Prepared output reply frames are provided to the computer; one is selected depending on the characteristics of the operator thought group of the input remark.

(4) Each reply frame has self-contained instructions that modify the essential thought groups of the output frame in accordance with the thought groups of the input remark.

All the above routines are included in the present program with the following exception: The thought groups of each input remark were coded, according to the arbitrary classification system used in this problem, by the human programmer himself before submission to the machine. In other words, the machine was presented with two numerical constants associated with each of the input thought groups, instead of having to search in a self-contained dictionary for the proper equivalent in the numerical bi-coded system. This procedure was followed because the preparation and use of a complete dictionary subroutine takes an enormous amount of time for the programmer, and consumes large amounts of machine time. Furthermore, the establishing of a one-to-one correspondence between input thought groups and machine-stored thought groups and associated numerical constants is not logically difficult. The present program is largely experimental in its handling of the logical relationships between thought groups in order to construct convincing conversation; the dictionary therefore can be prepared later when a full demonstration of the conversational powers of the computer are required, and when the logic of the computer program has proven itself equal to the task. Also, finally, the problems associated with the construction of a large machine-stored dictionary are amply dealt with in the literature of the machine translation field. (See references 2,3,4,5,6,7.)

Sample Computer Response to An Input Comment

A sample computer response to one of the input statements is here presented to illustrate the operation of the program in the computer.

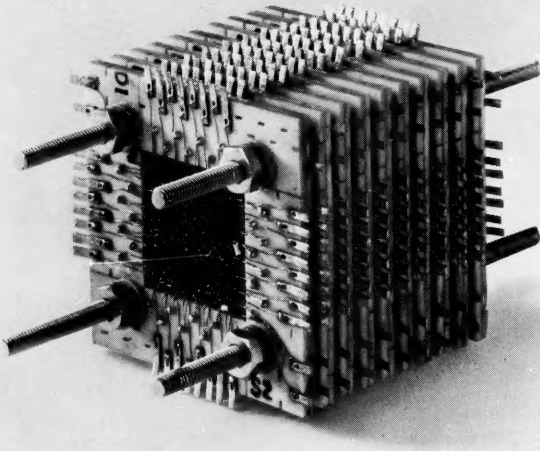
The input statement No. 17 is "June is the warmest month as all brides know." The computer receives the following octal information in its registers:

Subject registers: 604164452560
which is JUNE in BCD form.
Subject modifier register: 000000000000
Verb register: 300000000010
which indicates a verb of the "identity"
type (which "is" truly is).
Adverb register: 000000000002
This is stored in adverb register if there
is no negative word in the sentence.
Object registers: 606621514425
626360444645
633060606060
which is THE WARMEST MONTH, stored
in BCD form.
Object modifier register: 000000000000

This storing is accomplished by having the computer convert the alphabetic characters to binary coded decimal form, and by further steps.

After storing the above octal words in their appropriate registers, the machine searches the input words for the type of sentence the input comment is. The period in the sentence indicates to the machine that it is a "statement" comment; it then transfers to the statement subroutine. The period is coded as 000000000003 (see block diagram).

The machine then extracts the value of the bits in Columns 30 to 32 of the verb register, which in this case is a one. The machine then transfers to the instructions for printing the reply frame No. 1.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S2

This reply frame is of the form: "Well, (insert subject of the input comment) is certainly (insert object of the input comment) indeed. But that is the way I like it." When the inserts have been selected from the subject and the object registers respectively, the complete reply will read: "Well, June is certainly the warmest month indeed. But that is the way I like it."

All runs were made on the IBM 704 with the MIT automatic Operator Program assembler and operator.

Checking the Adequacy of the Computer Program

Before proceeding to complete and run the program, we considered how to evaluate the success of a program of this type. This is a challenging problem.

A direct method of testing was sought. The following was finally decided upon:

(1) A group of 25 input statements selected more or less at random from a large set of weather conversations actually collected from human beings would be given to the machine. The input statements would include statements of preference, exclamations, questions, or commentary.

(2) The same group of input statements would be given to a more or less randomly selected group of 9 human beings, and they would be asked to give their verbal reaction to each of the input statements.

(3) The single reaction of the machine, and the 9 reactions of the people, to each input statement, would be listed, but the order scrambled.

(4) A different group of people would then be shown the 25 input statements and the 250 replies (10 next to each input statement) and told the situation — that one of the 10 replies in each set had come from a computer, and that the others were from human beings. Each person in this group would then be asked to judge which one of the 10 replies for each of the 25 statements was from the computer.

(5) The degree of success of the latter group of judges in selecting the computer's replies would be taken as a measure of the failure of the program to fulfill the conditions of the problem. Thus, if the latter group were unable to point out the computer replies with any better than a random correlation, then the present program could be considered a success; and a solution to the conversation-with-a-computer problem in one field namely, weather conversation, would have been obtained.

II.

Computational Process

The steps in the computational procedure were as follows:

(1) Write name and title of program
(2) Print the input remark
(3) Analyze input thought groups, and place them in one of seven registers depending on their grammatical character.
(4) Analyze the overall meaning of the whole set of thought groups to see if it is a question, a statement, or an exclamation.
(5) Direct the computation process into the appropriate subroutine depending on the result of step (4).
(6) Check the input statement for a thought group specifying a negative relationship.
(7) Direct the computational process into the negative mood if answer to step (6) is yes.
(8) Analyze the character of the operator thought-group for quality.
(9) Direct the computation of output frame in accordance with result of step (8).
(10) Select reply frame.
(11) Execute the self-contained instructions of the chosen reply frame.
(12) Assemble the output frame.
(13) Print the selected and assembled output frame.
(14) Check for end-of-sequence of input statements.
(15) Go back to step (3) if more input statements are available.
(16) If no more input statements are available, print end of run, and halt and transfer.

Layout of Data in the Punched Card

The layout for storage of information in the punch card input about thought groups is summarized in the following:

Columns	Information Stored
1-3	Constant indicating grammatical class of input thought-group, i.e., in binary storage 110: object modifier th. gp. 101: object th. gp. 100: operator modifier th. gp. 011: operator th. gp. 010: subject th. gp. 001: subject th. gp. 000: undefined
4-26	Not used; blank.
27-32	Quality of thought group as numerical constant, i.e., for operator thought groups, 000110: desired, or wanted 000100: happening 000011: conception 000010: like or preference 000001: identity, tautology for operator modifier thought groups 000000: negative aspect 000001: positive aspect
33-35	Constant denoting the class of meaning for the sequence of thought groups, i.e., 001: question 011: statement 111: exclamation

Summary of Present Program Statistics

In the present program the degree of elaboration is as follows:

(1) The number of input statements used was 25.
(2) The number of output frames available to the computer was 30.
(3) The number of self-contained instructions in the output frames: 51.
(4) The number of grammatical classes used: 10, including the type-of-statement indicator.
(5) The number of classes of operator thought

groups: 10, including the ones defined by the negative modifier.

(6) The number of instructions in the program: 845.

(7) The number of decisions for each input statement: 9.

Each of the above is a first approximation. Each could be substantially increased, with improvement to be expected in the performance of the program as a whole.

In the evaluation of the program results, the input statements were shown to nine people, and their responses to each statement collected. Their responses were punched on IBM cards, arranged randomly with the computer responses, and the whole 250 statements listed by the IBM 407 tabulator. Then the entire listing was given as a questionnaire to 10 other people, who were each asked to point out the computer reply. The questionnaire appears in this issue of **Computers and Automation** entitled "Can You Tell the Computer's Responses from the People's Responses?". The results of this procedure are shown in Table 1.

TABLE 1

Input Statement No.	No. of Correct Choices	No. of Incorrect Choices
01	1	9
02	2	8
03	2	8
04	2	8
05	1	9
06	1	9
07	1	9
08	0	10
09	1	9
10	1	0
11	5	5
12	1	9
13	5	5
14	1	9
15	0	10
16	4	6
17	3	7
18	3	7
19	1	9
20	2	8
21	2	8
22	1	9
23	2	8
24	0	10
25	0	10
TOTALS	42	208

The results in Table 1 mean that the judging ability of the people for the 25 cases of output of the conversation program was 42/250 or 0.168 or 16.8%. This compares with the 10% that would be expected with completely random guessing and the 100% that would be expected if their guessing was perfect. If we should exclude input statements No 11 and 13, which were guessed by half the judges, and therefore were rather obvious machine production, the experiment demonstrates that the computer can in the great majority of instances generate conversational responses that are practically indistinguishable from those generated by intelligent human beings.

III.

Discussion

Analysis of the results show some interesting defects in the present type of programming, and suggest several improvements that can be made to polish the present approach. For example, in statement No. 12, the input is "I enjoy nothing more than rainy days in April." The phrase "nothing" is taken by the machine to be a negative, and the output reply comes in the negative mode ("Neither did I," etc.) However here "nothing" is coupled in the phrase "nothing more" which uses this negative word to reenforce a positive assertion. This confusion might be overcome in a modified program by inserting an additional subroutine which compares the negative thought group with its immediate surroundings to see if it fits into any of the frequently occurring combinations of "positive assertion by denial" phrases. Then these could be re-established in the positive mode. However such a task is not a small assignment, and it would have to be accompanied by considerable analysis of patterns of expressions, and commonly occurring syntax, in order for it to function effectively.

Another limitation of the present program is that it incorporates no memory of previous statements; the present program cannot modify the output statement to avoid contradiction of previous replies. In order for the computer to carry on a continuous conversation with someone and to meet the full details of Turing's criterion, some form of memory would have to be available to the machine so that it could not only modify its output statements on the basis of former output statements, but that it could also detect contradictions in the input remarks of the co-conversationalist. This additional ability would involve a great expansion of the present program, and many man-hours. However there is no reason to believe that no attempts will be made to accomplish this in the future.

The present program could be most readily improved by expansion in the number of categories that each grammatical thought group can be placed. Also the number of output reply frames, presently quite limited, could be easily expanded to provide considerable variety to the output forms, and to make each frame more appropriate to the corresponding type of input statements.

A detailed analysis of the amount of time that the programmer spent in setting up the problem, and the programming and running of it is included in Appendix F.

Conclusion

It has been shown that by using a relatively simple application of logical syntactical analysis of English sentences concerning the subject of the weather, it is possible to provide an electronic computer with the capability of creating responses in the form of English sentences which are largely indistinguishable from those expected of human beings.

The approach to the conversation-with-a-computer problem which has been presented in this paper is found to be successful by a statistical evaluation test, and to indicate that a grammatical attack is fruitful in solving the problem of programming a computer to handle thoughts with words.

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(1) E. C. Berkeley, L. E. S. Green, and C. C. Gotlieb, **Conversation with a Computer,** Paper presented at the meeting of the American Association for Advancement of Science, on December 28, 1959.

(2) Ashby, William Ross, **Design for a Brain,** New York, J. Wiley, 1952.

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(7) Locke, W., and Nash, W., **Machine Translation of Languages,** in **Machine Translation,** edited by Locke, W., and Booth, A.D., John Wiley and Sons, New York, 1955.

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Appendix

Reference 1 has not heretofore been printed. It consists of a short Section 1, a long Section 2 which consists of most of Reference 8, and a short Section 3. The paper is given below:

CONVERSATION WITH A COMPUTER

(Paper Presented at the Meeting of the American Association for Advancement of Science, on December 28, 1959, by E. C. Berkeley, L. E. S. Green, and C. C. Gotlieb)

1. Introduction by E. C. Berkeley

First, let me say that I am reporting on work by three people, and two of them have not had an opportunity to review what I am saying here. So please consider that my colleagues, Dr. C. C. Gotlieb, of the Computation Centre of the University of Toronto, and Mr. L. E. S. Green, of K. C. S. Data Control, Toronto, are not necessarily fully committed to what I shall say here.

Can a computer carry on a conversation? The answer to this question is "Yes", and the proof is here exhibited.

We are interested in this question, among other reasons, because, the English mathematician Turing, about 20 years ago, suggested that a machine could be said to be capable of thinking if it could carry on a conversation with a human being in another room, in such a way that the human being could not tell if he were conversing with a machine or with another human being. Since that time, this definition of a computer's thinking has stood as a challenge to computer people.

To make a beginning on the problem, it is clearly desirable to restrict it to some relatively simple and common subject such as the weather. About 1954 John W. Carr, III, now director of the computing center at the University of North Carolina, in a course on computers for students at the University of Michigan, assigned as an optional problem for additional credit the problem of programming a machine to carry on a conversation about the weather. But no student took up the challenge.

In December, 1958, the problem (which I phrased and analyzed as a part of a study I was making on language, ideas, and computers) was discussed with the Computation Centre of the University of Toronto. Dr. C. C. Gotlieb of the Centre classified it as a frontier problem having interest; and it was placed in the hands of L. E. S. Green, mathematician and programmer, to analyze, program, and code.

The first preliminary program ran in April, 1959, and showed a surprising degree of success, but also some "stupid" or "deaf" replies. The second preliminary program ran in August, 1959, and was a good deal more satisfactory; but this program also contains some undesirable responses for such reasons as failure to recognize certain English idioms, and incompleteness of syntactical analysis.

2. Report by L. E. S. Green on the Computer Program and Some Examples

(This is the same as the portion of the October, 1959, article commencing with column 2, paragraph 2, on page 9 and running to the end of the article on page 11.)

3. Some Final Remarks by E. C. Berkeley

I think that this experiment with an automatic computer provides convincing evidence for some very important propositions about computers and about ideas. I will now state these propositions:

1. Theorem: A computer can operate reasonably with ideas.

2. Theorem: An idea for computer purposes is a specification of the meaning of a word or string of words.

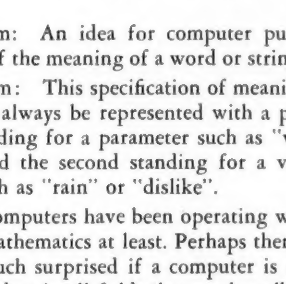
3. Theorem: This specification of meaning can very often but not always be represented with a pair of symbols, one standing for a parameter such as "weather" or "emotion" and the second standing for a value of the parameter such as "rain" or "dislike".

After all, computers have been operating with ideas in the field of mathematics at least. Perhaps then we should not be too much surprised if a computer is also able to operate with ideas in all fields that can be talked about in language.

I will now make two predictions:

Prediction 1: It will not be many years — I would estimate hardly more than ten years — before the operating of computers with ideas will be widespread.

Prediction 2: When computers do operate generally with ideas, it will be impossible for a human being in another room to tell whether he is conversing with a computer or with a human being.



Can You Tell The Computer's Responses From The People's Responses?

Patrick J. McGovern,
Assistant Editor, Computers and Automation;
Mit Ibm Sevenohfour,
Cambridge, Mass.;
and Nine People, Anonymous

Note: To fully understand this questionnaire, see the article in this issue "Computer Conversation Compared with Human Conversation" by Patrick J. McGovern.

For each one of the 25 comments in the following questionnaire, there are 10 responses. One response was generated by a computer. The other nine responses were generated by human beings. The ten responses for each comment were then scrambled; which one of the ten is the computer's response is randomly different from set to set. After scrambling the responses, the questionnaire was assembled and printed on an IBM Tabulator and presented to ten persons who acted as "judges" and who were asked to identify the computer's responses, distinguishing them from those collected from the nine human beings.

The results of the choices of these ten judges are reported in Table 1 of the article mentioned above.

To try this questionnaire yourself, THE FIRST TIME that you read through this questionnaire, choose that one of the ten responses to each comment which you judge came from the computer. Record your choice for each one of the 25 comments. Then compare your choices with the key which will be published in the next issue of **Computers and Automation.** Note: It is not fair to compare the responses set by set, and apply smart reasoning'

QUESTIONNAIRE

Below are a series of comments made concerning the topic of the weather. Following each of these comments are a group of ten replies to these comments. One of these replies was made by the IBM 704 Computer at M.I.T. Would you indicate which of the replies came from the computer in your estimation? Thank you very much for your cooperation in this conversation project.

In these comment statements a 7 stands for a question mark and a 1 stands for an exclamation point. [In the following as printed, however, the 7 has been changed into a question mark and the 1 has been changed into an exclamation point.]

This is the comment:

Look at those clouds! It is going to rain again?

And these are the replies to the above comment:

1.1( ) Haven't we had enough?
1.2( ) I don't think so.
1.3( ) I hope not.
1.4( ) Perhaps it will blow over and get sunny again.
1.5( ) Rain! Rain! Go away, and come back again some other day.
1.6( ) So what! Bribe a witch doctor!
1.7( ) If you think it will, then it won't!
1.8( ) No, the sky is falling in.
1.9( ) Possibly.
1.10( ) Well, if rain comes, I won't be the only one to complain.

This is the comment:

What did you think of all the snow we had last winter?

And these are the replies to the above comment:

2.1( ) I don't think we had much snow last winter.
2.2( ) Let's forget it.
2.3( ) Well, it melted, didn't it?
2.4( ) I am one who believes in the sun, and in the need for time to enjoy it.
2.5( ) Unexpressible.
2.6( ) I thought it was hilarious.
2.7( ) I didn't think of it.
2.8( ) I did not mind it too much.
2.9( ) What kind of stupid question is that?
2.10( ) Hard to dig the car out.

This is the comment:

Would you mind if we had cloudy and windy weather now?

And these are the replies to the above comment:

3.1( ) Natch!
3.2( ) Yes.
3.3( ) Yes, I certainly would.
3.4( ) I like windy weather.
3.5( ) No.
3.6( ) I might mind, but I couldn't prevent it.
3.7( ) Rather not!
3.8( ) I usually do not mind windy weather if it is not too persistent.
3.9( ) Not after all this heat.
3.10( ) Any kind of weather in this region is bad.

This is the comment:

You really can't truthfully say you like hot weather?

And these are the replies to the above comment:

4.1( ) I do like to go swimming when it's hot.
4.2( ) Why should I be truthful?
4.3( ) Do you want to bet?
4.4( ) I don't. Why, I can truthfully say I don't like hot weather.
4.5( ) Why not?
4.6( ) Yes.
4.7( ) I agree.

4.8( ) Neither do I, frankly.
4.9( ) I do like it.
4.10( ) No, I can't.

This is the comment:
I prefer the wintry blizzards to this dreary season.
And these are the replies to the above comment:
5.1( ) It's pretty difficult to get about in a blizzard, though.
5.2( ) If I can curl up by the fire.
5.3( ) So do I!
5.4( ) Not me.
5.5( ) Anything is preferable to school.
5.6( ) Go north.
5.7( ) So do I really.
5.8( ) To tell the truth, I do not enjoy wintry blizzards as much as you seem to.
5.9( ) Schmuck!
5.10( ) I don't!

This is the comment:
There is no time I like less than a hot day in July.
And these are the replies to the above comment:
6.1( ) Not I, I love beach weather.
6.2( ) You can say that again. I do not like a hot day in July any more than you do.
6.3( ) Or August. . . . . .
6.4( ) Well, I like hot July days.
6.5( ) Yea!
6.6( ) I don't like any hot days.
6.7( ) Or no person I like less than you.
6.8( ) Then you must like July often.
6.9( ) What do you like more?
6.10( ) As long as it's not humid.

This is the comment:
What kind of weather do you want this spring?
And these are the replies to the above comment:
7.1( ) I would like warm, sunny days, but what I want and what we're likely to get are quite different.
7.2( ) Fair and cool.
7.3( ) Warm, sunny days.
7.4( ) In May I like nothing better than a full day of sunshine and an evening shower.
7.5( ) Hot!
7.6( ) I hope it showers.
7.7( ) Warm.
7.8( ) Mild weather — the milder the better.
7.9( ) Spring? I thought we just had spring.
7.10( ) Warm.

This is the comment:
Look at that rain come down!
And these are the replies to the above comment:
8.1( ) If it doesn't stop soon, we are apt to have flooding.
8.2( ) Good for the grass!
8.3( ) Thundershowers in June rain heavily.
8.4( ) You look. I'm sick!
8.5( ) Whee!
8.6( ) Open your mouth.
8.7( ) Who tells you to go out?
8.8( ) Like a waterfall!
8.9( ) Joy to the world. I could think of nothing better.
8.10( ) We needed it.

This is the comment:
Some blizzard this is!
And these are the replies to the above comment:
9.1( ) I hope it won't last long.
9.2( ) Let's go south!
9.3( ) The biggest in the last three years.
9.4( ) You're not kidding. It is a terrible blizzard.
9.5( ) Can't even see your hand in front of you.
9.6( ) Every time I have a final.
9.7( ) So!
9.8( ) Not as bad as last year.
9.9( ) Remember the St. Pat's day blizzard in 1958.
9.10( ) What a disappointment.

This is the comment:
I have never seen it so hot!
And these are the replies to the above comment:
10.1( ) Oh, don't be such a sissy.
10.2( ) You probably have, but don't remember.
10.3( ) I'm sure I say this several times a year.
10.4( ) Nor have I. But it does not bother me.
10.5( ) Good day for a tan.
10.6( ) Because it's my vacation.
10.7( ) Turn around.
10.8( ) You haven't been to Madrid lately, have you?
10.9( ) Almost as bad as the Sahara on my last trip.
10.10( ) You're exaggerating.

This is the comment:
Snow, 10 inches deep, is my favorite weather.
And these are the replies to the above comment:
11.1( ) You must be a ski enthusiast.
11.2( ) Not mine!
11.3( ) Yes, my favorite weather is certainly snow, indeed. But that is the way that I like it.
11.4( ) It is not mine.
11.5( ) Yee Gads!
11.6( ) Because it's no school.
11.7( ) Stay in it.
11.8( ) You must live on the second floor.
11.9( ) You don't have to shovel it?
11.10( ) You're crazy.

This is the comment:
I enjoy nothing more than rainy days in April.
And these are the replies to the above comment:
12.1( ) I can think of more pleasant things to enjoy.
12.2( ) But not too many.
12.3( ) Not really!
12.4( ) You're crazy.
12.5( ) April is the cruellest month.
12.6( ) Neither did I. Everything about New England is so unpredictable.
12.7( ) Yes. In May and June too.

12.8( ) You must be having a very comfortable time.
12.9( ) Why April?
12.10( ) It's pleasant.

This is the comment:
I want this rain to stop immediately.
And these are the replies to the above comment:
13.1( ) I'm afraid it's not up to you to control it.
13.2( ) It would be nice to be able to turn it off.
13.3( ) So do all small boys.
13.4( ) Too bad!
13.5( ) Because it's drowning the bugs.
13.6( ) That's too bad.
13.7( ) Don't be too fussy in this part of the year.
13.8( ) I am hoping for the rain to stop.
13.9( ) Don't say it! It will last forty more days
13.10( ) If Canute couldn't do it, you certainly can't.

This is the comment:
When do you think our first real hot day will come?
And these are the replies to the above comment:
14.1( ) It's usually around Memorial Day.
14.2( ) Never, I hope!
14.3( ) Not before June this year.
14.4( ) August maybe.
14.5( ) After I die.
14.6( ) I don't know.
14.7( ) All too soon for me.
14.8( ) It's hot enough for me right now.
14.9( ) I don't know.
14.10( ) Well, I enjoy a hot day if it is not too persistent.

This is the comment:
Snow usually arrives when you least expect it.
And these are the replies to the above comment:
15.1( ) We should be prepared for it.
15.2( ) I expect it from December to March.
15.3( ) I disagree — you can predict snow often.
15.4( ) Not so. It arrives when you don't want it.
15.5( ) Like death.
15.6( ) Good.
15.7( ) All too often it does.
15.8( ) Well, I never miss snow, so I am not disappointed.
15.9( ) Yeah! Just when you take the snow tires off your car.
15.10( ) Listen to the weather report.

This is the comment:
I think that this fair weather will not last.
And these are the replies to the above comment:
16.1( ) Who can tell?
16.2( ) What pessimism!
16.3( ) I don't think so either.
16.4( ) It certainly looks that way, doesn't it.
16.5( ) I hope you are wrong.
16.6( ) Who gives a damn?
16.7( ) Who cares!
16.8( ) In New England it never does.
16.9( ) No! We'll probably have a storm tomorrow.
16.10( ) I can't tell.

This is the comment:
June is the warmest month as all brides know.
And these are the replies to the above comment:
17.1( ) Not necessarily.
17.2( ) Not because of the weather, though.
17.3( ) July and August are warmer.
17.4( ) Thanks for the advice.
17.5( ) April is the cruellest month.
17.6( ) I don't like brides.
17.7( ) But the frost usually comes in August.
17.8( ) Oh boy!
17.9( ) Yes, June is certainly the warmest month indeed. But that is the way I like it.
17.10( ) They would!

This is the comment:
Skiing fans will certainly like today's blizzard.
And these are the replies to the above comment:
18.1( ) It's not much fun for the non-skiers.
18.2( ) But, oh, my aching back.
18.3( ) Yes, they will.
18.4( ) I hate ski fans.
18.5( ) To tell the truth, I do not enjoy today's blizzard as much as you seem to.
18.6( ) But it will spoil the baseball game.
18.7( ) I don't ski.
18.8( ) Yes, but not the gardener.
18.9( ) I don't know! It'll be a while before the roads are opened.
18.10( ) You're right!

This is the comment:
April is not the month to be caught without an umbrella.
And these are the replies to the above comment:
19.1( ) It usually rains when I don't carry my umbrella.
19.2( ) I'll take my chances. I surely don't like umbrellas.
19.3( ) I agree.
19.4( ) All months in Boston are such that you don't want to be caught without an umbrella.
19.5( ) I really didn't look closely enough to tell.
19.6( ) April is the cruellest month.
19.7( ) Or without clothes.
19.8( ) Yes, I was soaked to the skin yesterday.
19.9( ) I've never used an umbrella.
19.10( ) It rains so often!

This is the comment:
O boy, last night's frost covers all the windows.
And these are the replies to the above comment:
20.1( ) I wonder what the temperature was last night.
20.2( ) Too bad for the plants in the garden.
20.3( ) Yes, it is pretty cold.
20.4( ) Are you crazy?
20.5( ) The frost is memory.
20.6( ) Good for the orange crop.
20.7( ) Now we won't be able to watch you shovel snow.
20.8( ) It certainly looks that way, doesn't it?
20.9( ) Yeah, aren't they pretty!
20.10( ) I can't see.

This is the comment:
It's raining cats and dogs!
And these are the replies to the above comment:

21.1( ) That old cliché!
21.2( ) I'll stay in and keep dry.
21.3( ) It sure is.
21.4( ) You can't be outside for a second or you'll be drenched.
21.5( ) And the puddles are barking.
21.6( ) More experiments!
21.7( ) You're not kidding. It is terribly raining.
21.8( ) I don't give a bark.
21.9( ) I hope my cellar doesn't flood.
21.10( ) Really!

This is the comment:
No one wants to see snow in September.
And these are the replies to the above comment:

22.1( ) That would be unusual for this part of the country.
22.2( ) I should say not!
22.3( ) Right!
22.4( ) Don't you think that snow must be good for somebody.
22.5( ) That's for sure!
22.6( ) Because snow is doubly symbolic.
22.7( ) Or you for that matter.
22.8( ) Only a skiing fan that is.
22.9( ) Who says?
22.10( ) It's welcome then.

This is the comment:
I want to go walking in the rain.
And these are the replies to the above comment:

23.1( ) I am hoping for walking in the rain just as much as you.
23.2( ) Everyone to his own taste!
23.3( ) I might, but it would have to be mist rather than heavy rain.
23.4( ) Often at college I went walking in the rain.
23.5( ) You'll catch cold.
23.6( ) It appeals to all five senses.
23.7( ) Go ahead!
23.8( ) Why? Haven't you taken a shower lately?
23.9( ) I've always enjoyed that, too.
23.10( ) So long as it's warm.

This is the comment:
Planes cannot fly well in snowy weather.
And these are the replies to the above comment:

24.1( ) They are usually grounded when it snows.
24.2( ) I wouldn't want to take a chance of flying in snow if they could.
24.3( ) Well, I never miss planes so I am not disappointed.
24.4( ) Not true. As soon as the snow is cleared off the airfields, the planes can fly again.
24.5( ) They freeze up.
24.6( ) Because they're incongruous with nature.
24.7( ) They should.
24.8( ) Too bad; that's the best time to fly on vacation.
24.9( ) Take a bus!
24.10( ) It's dangerous!

This is the comment:
The snow is turning into rain.
And these are the replies to the above comment:

25.1( ) That is obvious.
25.2( ) Good, no shoveling.
25.3( ) This will make driving very difficult.
25.4( ) Good!
25.5( ) Because the factories are lousing up the world.
25.6( ) So what!
25.7( ) Joy to the world. I could think of nothing better.
25.8( ) Boy, now we shall see slush aplenty.
25.9( ) The whole business may freeze tonight making tomorrow's driving fun.
25.10( ) I shouldn't have shovelled out my car.

That is all. Thank you again.

NEWS of Computers and Data Processors

"ACROSS THE EDITOR'S DESK"

COMPUTERS AND AUTOMATION

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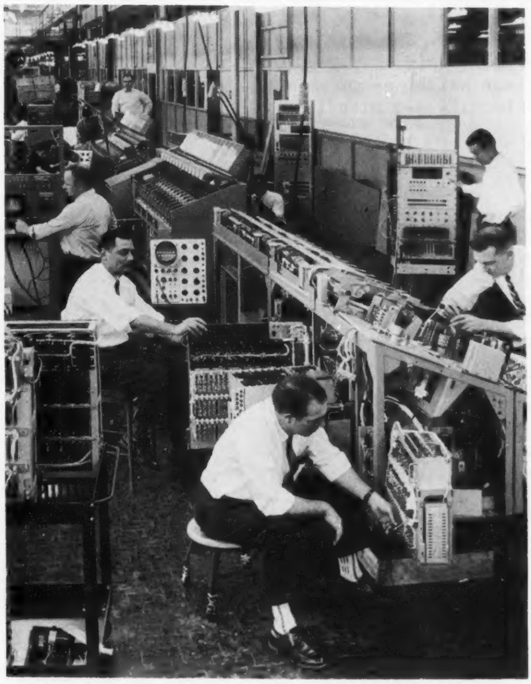
50 ELECTRONIC SORTER-READERS TO BE DELIVERED TO 25 BANKS THIS YEAR

Burroughs Corp.
Detroit 32, Mich.

This company will deliver nearly 50 electronic sorter-readers (using magnetic ink character recognition) to some 25 banks before the end of the year. Banks in 7 states have received them already.

Equipment is being produced against a backlog of $6,500,000 of orders. Magnetic ink character recognition (MICR) equipment is being delivered also to handle data processing tasks for hospitals, financial publishing companies, an engineering institute, and other commercial businesses. Scores of commercial banks, savings banks, and savings and loan associations have already started encoding checks, deposit slips, and other documents with MICR numbers and symbols, in preparation for reading and processing these items automatically.

The sorter-reader reads and processes checks, deposit slips, and other MICR-encoded items at speeds up to 26 per second. Items can be sorted 15 to 20 times faster than under a manual system. The machine accelerates checks or other items from a "standing start" to about 23 miles an hour in a distance of four inches. The machine reads each MICR digit or symbol in 32-millionths of a second. It processes intermixed documents of varying sizes and thicknesses, as well as items that have been folded, stapled or torn. It can be loaded and unloaded while operating at full speed, thus providing unlimited capacity.



Burroughs Corp. engineers and technicians are shown working on a portion of the production line set up by the company to produce MICR (magnetic ink character recognition) electronic sorter-readers. The $63,000 machine reads and processes bank documents at speeds up to 26 items a second.

100,000 BITS OF INFORMATION IN 6 OUNCES OF MEMORY DRUM

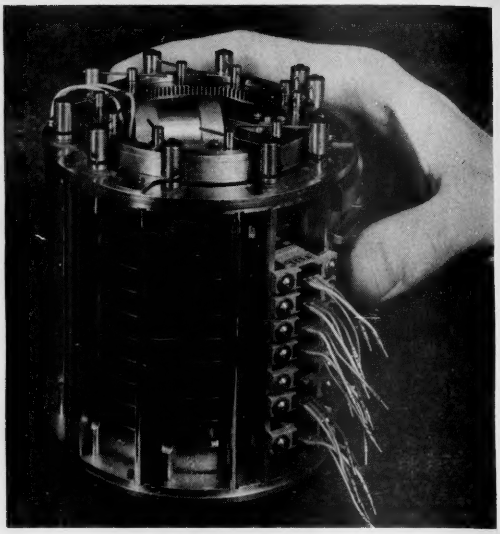
International Business Machines Corp.
Federal Systems Division Laboratory
Owego, N. Y.

A way to put 100,000 bits of information into a 6 ounce memory drum that can be held in the palm of a man's hand, has been found.

The information is recorded on the magnetic surface of the tiny stainless steel drum, which was designed for airborne computers. The new drum, 3 inches long and 3 inches in diameter, can hold as much information as a much heavier conventional drum -- 16 inches long and 4 inches in diameter -- used on many larger earth-bound computers.

The new drum is only a thin steel shell. This construction was devised to withstand severe vibrations and shock. The "shell" design concentrates the drum's mass at the surface, where it is most needed, IBM engineers explain. The construction, therefore, provides maximum strength and rigidity with minimum weight -- prime considerations in both aircraft and missiles.

Surrounding the rotating drum is a lightweight frame on which miniature magnetic pickup and recording heads are imbedded in rectangular blocks of plastic called "slider bearings". These bearings slide over the surface of the drum on a cushion of air, staying only 100 millionths of an inch away from the drum even under the most severe vibration conditions.



Total weight of the miniature drum assembly is 8 pounds, compared to about 235 pounds for conventional drum assemblies.

The shell design enables the drum to withstand stress more than 15 times the force of gravity. The tiny drum, which spins at 6000 rpm, is so rigid that it is not affected by even the high frequency vibrations found in missiles.

AUTO-CONTROL SYSTEM' FOR PHILCO COMPUTER

Philco Corp.
Willow Grove, Pa.

A new programming and hardware control system for the PHILCO-2000 electronic data processing system, has been developed. Called the "Auto-Control System", it provides an automatic interrupt feature and increases the efficiency of the computer in other ways.

The interrupt capacity of the "Auto-Control System" is completely under program control; it permits the programmer to determine the system conditions that shall be checked, when these conditions shall be checked, and the action to be taken when these conditions are present.

In addition to increasing the powers of the programmer, the "Auto-Control System" makes efficient use of program time by automatically monitoring computer operations.

The new system also increases the scope of the entire PHILCO 2000 computing system by the expansion of real-time capabilities, and by the interlacing of several problems on a programmed priority basis.

All conditions to be checked are indicated by one register in the "Auto-Control System". Each bit in this register is designated to represent the presence of a certain condition, and when that condition is present the bit is set to one. The priority given to these conditions is up to the discretion of the user. The bits that cause the program to be interrupted are determined by a mask which is designated by the programmer. If a condition which sets one of the bits in the register is detected, and if that bit is covered by the mask, the program is interrupted. A transfer is then made to an executive routine which jumps to a separate subroutine for each condition. These subroutines are prepared by the programmer and permit him to program what actions he feels are necessary for any specified condition. The inclusion of a register with variable priority, a programmed-controlled mask, and flexible subroutines gives the programmer control of the entire computing system through "Auto-Control".

NEW RANDOM-ACCESS DISC-MEMORY WITH FLYING HEADS

Telex, Inc.
1633 Eustis St.
St. Paul 1, Minn.

A high-capacity disc-file memory, incorporating multiple read-record heads that "fly" over the surface of storage discs, has been developed and is going into production. It is designed to provide very high storage capacities and random access speeds.

The Telex II Disc File has a capacity of nearly 100 million characters, a 10-to-one advantage over existing disc-file mass-memory units. Access time has been reduced from 700 milliseconds needed by present equipment to 150 milliseconds for the Telex Disc File. At the same time, cost is a fraction of that for memory systems of comparable performance.

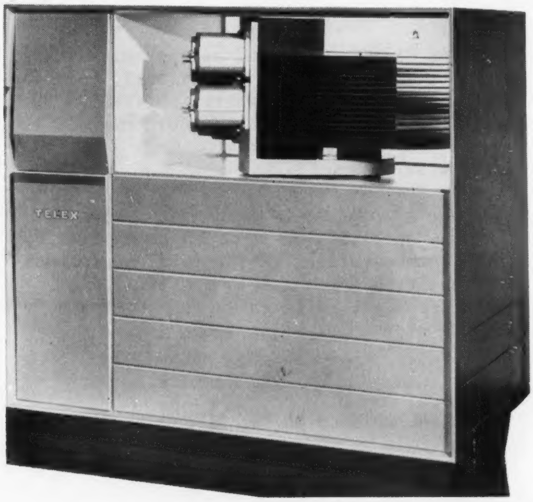
A major key to the performance of these disc files is the airfoil-like design of the read-record heads, which allows the heads to ride on the air boundary layer of the rapidly-revolving discs. This makes practical the multiple mounting of heads, two pair operating in conjunction with each of the 31-inch recording discs.

The recording discs are spaced on a vertical, motor-driven shaft. The read-record heads are mounted in opposed pairs on a two-pronged positioning arm for each disc so that one pair of heads serves the upper surface of the disc, the other, the lower surface. The positioning arms are driven by an electro-magnetic motor with the track-locating dimensional references built into the magnetic field of the motors.

Since each disc has its associated head positioner and heads, no time is spent in moving the read-record heads from disc to disc. In actual operation, two or more of the head positioners may be in motion at the same time.

A single disc with its associated head positioner and heads could serve with necessary control as a complete random access memory. Desired capacity is achieved by adding more discs.

The Telex II, with a capacity of 617 million bits, uses 64 recording discs and head positioners, each with its two pairs of read-record heads. A smaller version, the Telex I, with 16 discs and smaller storage capacity per recording surface, has a storage capacity of 154 million bits.



The Telex II Disc File including its cabinet measures 84 inches long, 60 inches high and 32 inches deep. It weighs about 3,000 pounds and has power consumption of 7 kilowatts.

The head actuator design was developed by Tronics Corporation, a Minneapolis electronics company, and is licensed to Telex for its present application. Recording discs are produced by Minnesota Mining and Manufacturing Company, St. Paul, under a proprietary process.

CONVERSION FROM ANALOG SIGNAL TO DIGITAL CODE 5 TO 30 MILLION TIMES PER SECOND

Epsco, Inc.
275 Massachusetts Ave.
Cambridge, Mass.

In the field of conversion from analog signal to digital code, a new family of subminiature translators able to provide 5 to 30 million independent voltage data conversion operations per second has been developed by this company.

These components are based on new, radical concepts of component development, circuit configuration and logical approach. The size is small: for example, a 7 bit megacycle converter, exclusive of power supply, requires a volume of only 7 cubic inches. The associated power supply occupies a volume comparable to that needed for converters of conventional type.

The new devices operate asynchronously. They continuously digitize a varying input and provide a parallel coded output. Serial-pulse-train output buffers have also been developed for use with the units.

The converter is not an incremental device but does, in fact, make totally independent full-scale-to-full-scale conversions in milli-microseconds. The digital read out is 0 volts for a binary one and minus 6 volts for a binary zero.

The new device is expected to open up wide new applications in video communication, space communication, experimental neurophysiological study, radar data analysis, high speed transient pulse analysis, submarine warfare signal detection, etc.

DYING LETTERS ON THE TELEPHONE DIAL

Bell Telephone System
New York, N. Y.

With more and more people ordering telephones, and more and more central offices needed to provide service for them, there are indications that the telephone companies will exhaust new combinations of telephone numbers early in the 1970's, so long as the system of two letters and five figures for a telephone number is used.

This system wastes capacity of the dial because a prefix like one of GHI for the first letter and one of WXY for the second letter is excluded; also, there are no letters for the one position and the zero position on the dial.

Accordingly, "all-number calling", making use of telephone numbers of seven figures and no letters, is being planned for. This changed arrangement is expected to be usable until the early years of the 21st century.

COMPUTER PROGRAMMING TO DETERMINE MISSILE AND ROCKET FUEL REQUIREMENTS

The Service Bureau Corp.
2706 Wilshire Blvd.
Los Angeles 56, Calif.

A computer program to determine fuel requirements for rockets and missiles has been worked out by this company.

The program immediately computes performance data on rocket fuels with 20 atomic species, 250 molecular species, and 20 condensed phases. A number of mathematical and chemical approaches are used in the computer program to increase the speed and probability of convergence.

Standard data sheets are available to users of this program for them to submit their problems.

The company is also providing aid in the research and planning of computational problems for fuels and propellants for rockets and missiles.

MODERNIZED RAILWAY COMMUNICATION SYSTEM

General Electric Co.
Communication Products Dept.
Lynchburg, Va.

Southern Railway System has placed an order with this division of General Electric for a newly developed multi-channel microwave and two-way radio communication system. It is to be installed between Washington, D. C., and Atlanta, Georgia, at a cost of four million dollars.

The new Southern Railway communications system will cover a route of 637 miles but will have approximately 12,000 channel miles; this will make it the largest privately-owned microwave system in the United States. (The longest private microwave system presently in use is operated by Transcontinental Pipeline over 1,800 miles between New Jersey and Texas.)

Southern's communication network will consist of 54 microwave stations; completion is expected in late 1961. The equipment will replace Southern's telephone and telegraph pole lines between Washington and Atlanta. Practically all of Southern's train and yard operations, as well as maintenance and construction activities, now depend on radio. The new microwave and two-way radio system will provide greater reliability than the present pole lines, which are vulnerable to snow, ice and heavy wind storms. The new system will also make it possible for Southern to extend its infra-red ray hot-box detector system.

INVITATION FOR PROPOSALS FOR DOCUMENTATION RESEARCH

National Science Foundation
Documentation Research Program
Office of Science Information Service
Washington 25, D. C.

The National Science Foundation has announced it will consider proposals during the current fiscal year for additional research projects or studies of a fundamental or general nature that may produce new insights, knowledge, or techniques applicable to scientific information systems and services. Although the Foundation will consider any proposal for a project that may contribute to the general goal of improving the handling of scientific information, the following research areas are of the greatest interest at present:

1. Information needs of the scientific community. Studies or experiments to provide better understanding of scientific communication processes, scientists' information needs, and the extent to which needs are met by existing publications and information services, or could be met by proposed new types of publications and services.

2. Information storage and retrieval. Research on the systematization and mechanization of procedures for handling large volumes of scientific information, including procedures for automatic analysis of texts of documents, automatic indexing and abstracting, and automatic searching of stored materials; and tests and evaluations of existing, newly developed and proposed procedures for handling scientific information.

3. Mechanical translation. New groups wishing to undertake research on mechanical translation procedures and related studies of language should give first consideration to building upon and complementing the intensive work already accomplished by established groups.

The semiannual report Current Research and Development in Scientific Documentation, available from the Foundation, describes existing projects in the U. S. and abroad.

Inquiries and proposals should be addressed to us.

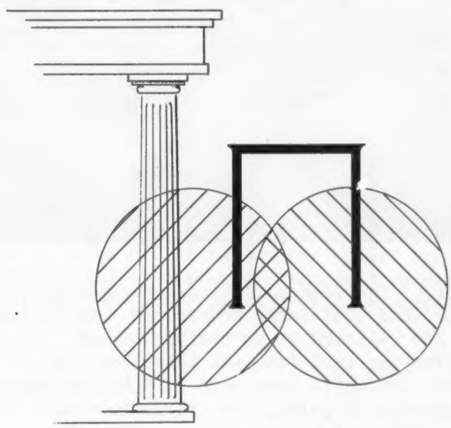
HIGH-SPEED COMMON-LANGUAGE COMMUNICATION BETWEEN SATELLITES AND EARTH STATIONS

Systems Division
Beckman Instruments, Inc.
325 North Muller Ave.
Anaheim, Calif.

This company is designing two high-speed data processing systems which will be used in conjunction with current Air Force satellite programs. These systems will control the flow of data between satellites in orbit and the earth.

The system will communicate in not one but many data "languages" with a world-wide network of input and output equipments, including telemetry systems, command RF links, high-speed digital computers, teletype and high-speed digital ground links and multiple ground control consoles; they will convert all data into a common language. Combining flexible operation with extremely high speed (almost four million bits per second), these systems will eliminate the need for special digital computers or other equipment to link data collection and data processing equipments.

High-speed core memories and stored programming will be incorporated into these systems.

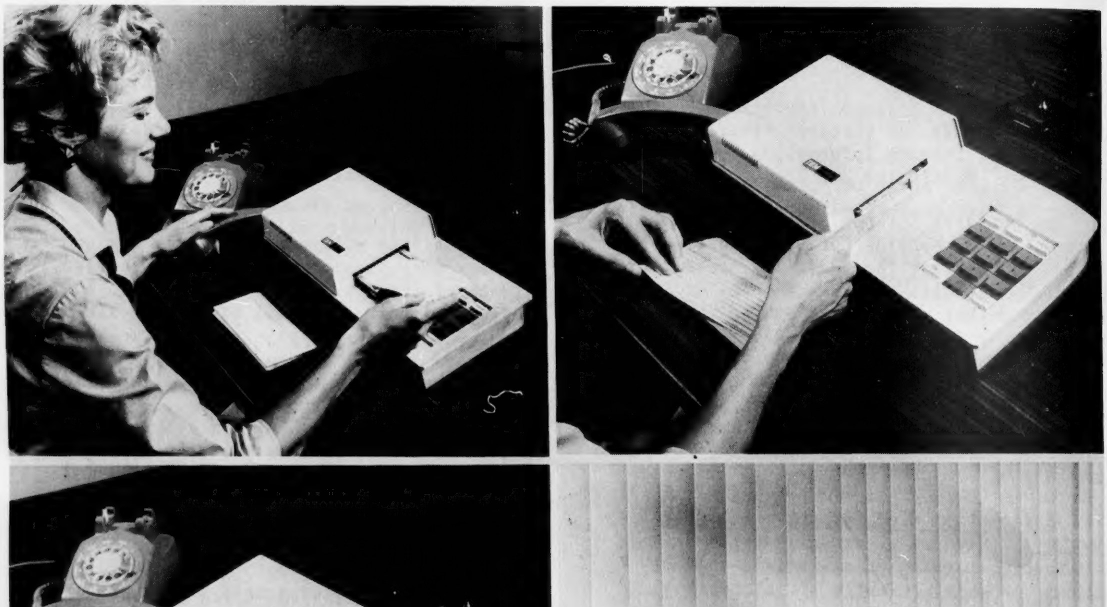


DATA TRANSMISSION AT LOW COST OVER THE TELEPHONE

International Business Machines Corp.
Data Processing Division
112 East Post Road
White Plains, N. Y.

For organizations operating at one or more locations, an economical way for sending information in machine language over local or long distance telephone lines to a central processing point has been developed. This has been called the IBM 1001 Data Transmission System. It is used with telephone company service, such as the Bell System Data-Phone, and it transmits both fixed data from prepunched cards and variable data manually entered on a keyboard. The data is received at the central processing point punched into cards; the cards in turn can be fed directly into an IBM data processing system for automatic handling of payroll, inventory control, billing, or other accounting operations on a centralized basis.

The sending station in the system includes a telephone, a "terminal" which is smaller than a typewriter and contains a simple card



TOP LEFT: The sending station operator has dialed the central processing point. She inserts a punched card containing prepunched numerical data. TOP RIGHT: Carriage is then moved to the left, and released on an audible signal. It then returns to the right-hand position, transmitting data from the card into the telephone line at about 12 columns per second. BOTTOM LEFT: The operator transmits some more information manually from the keyboard. BOTTOM RIGHT: At the central processing point, the transmitted data is received and punched into cards ready for further machine processing.

reader and keyboard, and a modulating subset available through the local telephone company. A speaker in the terminal automatically sounds audible signals at various steps in the operations for guidance of the operator. The central receiving station consists of a telephone, an IBM card punch modified with a data translator, and a telephone company demodulating subset.

The operator at the transmitting station makes the connection with the receiving station by dialing a telephone in the usual way. She transmits information by either inserting prepunched cards into the terminal or manually entering numeric data on the keyboard. At the receiving station, the telephone can be set to answer the sending station call and to punch the transmitted data into cards automatically with minimum attention from the operator. Both telephones can also be used for ordinary voice communication between the two stations.

The transmitting terminal of the system reads and transmits data from a card at the rate of approximately twelve card columns per second. A maximum of twenty-two consecutive columns of numerical data is read from each card. Variable numerical information can be manually keyed into each output card by the sending station operator. The system will handle 8 to 12 card transactions per minute. The card reader on the transmitting terminal can be specified for 80, 51, and 22 column IBM cards. The telephone company modulating and demodulating subsets convert the punched card code impulses to audio signals for transmission at the sending end and convert the audio signals into impulses used for card punching at the receiving end.

Automatic checking features in the system assure the accuracy of the data transmitted and received. Both stations are automatically signalled if an error is detected at the receiving station. When data from a record has been transmitted, the sending station operator simply presses a key on the keyboard to eject the card just punched at the receiving end and to feed in a blank card ready for the next transmission. A total of 79 columns of information from several input cards can be combined into a single output card.

CORE MEMORY EXPANDS, UPDATES, COMPUTER NORC

Daystrom, Inc.
Murray Hill, N.J.

A modern, solid-state memory has updated the U.S. Navy's Naval Ordnance Research Calculator (NORC) installed at the Naval Proving Ground, Dahlgren, Va., and in constant operation since 1955 when delivered by the manufacturer, IBM. It gives the giant computer an even larger problem capacity while reducing the time lost to maintenance.

Designed and built by Daystrom, Inc., Military Electronics Division, Archbald, Pa., the new memory increases the computer's storage capacity from 132,000 bits to 1,320,000 bits of information while reducing the computer down-time from an average of 8 hours per week to one hour per week.

The new memory is of the magnetic core type. Electrical impulses switch the direction of magnetism of the cores, and the arrangement of core patterns plus address switching allows subsequent signals to seek out computer-type "yes" or "no" answers to be fed back into the computer as numbers. The memory will retain information even after power failure.

Associated design features which permitted the new memory to be adapted to the NORC are:

(a) Transistor switching circuits, which permit the new solid state memory to work with NORC in the same manner as the older and totally different type memory.

(b) Special circuits, which transpose the higher voltage signals associated with NORC's older vacuum tube circuitry down to the lower levels associated with the modern transistor practice. This feature enabled the memory conversion to be accomplished with a minimum of interruption of the computer's operating schedule.

The original memory was based upon signals stored on the faces of 264 three-inch cathode-ray tubes. Maintenance of this system involved frequent adjustments and fairly frequent replacement of tubes at a cost of $150 to $175 each. In contrast, the all magnetic cores of the new memory should have unlimited life and require virtually no maintenance beyond the usual preventive checks.

HIGH SPEED CONTROL OVER POSITIONING AND DRILLING HOLES IN CIRCUIT BOARDS

Micro-Path, Inc.
Los Angeles, Calif.

An automatic machine for high-speed drilling of circuit boards has been developed by this company. It is designed to increase hole-positioning accuracy to one-thousandth of an inch, practically eliminate human error, and save a substantial number of man-hours in programming.

Coupled with this company's magnetic tape control, the new MPI 440 automatic circuit board drilling machine is capable of drilling 40 holes per minute with each drill head; 640 holes per minute with four stacks of four boards each; with an average positioning time of less than one second.

One of the more unusual features of the machine is its optical programmer. Essentially a comparator equipped with a large viewing screen, the programmer is simple to operate, making it possible for a speed-up in programming as well as significantly reducing the number of hole-positioning errors.

Until now two time-consuming methods of drilling circuit boards have been in use. Small shops frequently etch a first board master to be used in preparing a steel drill guide.

Board drilling then is done manually; the all-too-frequent result is that holes missed are found when the boards are partially assembled with electronic components. Also, the accuracy of the hole position is generally inadequate with this method.

The second method uses the contact negative master of a first etched board, and then the painstaking recording of the numerical values of the X and Y coordinates of positions for each hole, utilizing a toolmaker's microscope. These values are typed on a program sheet and a punched tape record is prepared for use with a numerically controlled drilling machine.

Each of these methods requires the fundamental step of locating the positions for drilling.

The new Micro-Path system eliminates the process of establishing and recording the X and Y coordinates of each hole to be drilled. To program the MPI 440, the operator inserts either an etched master board, or the negative to be used for contact printing, into a viewing slide located directly beneath the positioning table. A conventional comparator projects a small portion of the view, magnified 20 times on the 14-inch screen. A joy stick control enables the operator to center the image of the individual holes within a tolerance circle superimposed on the screen. As soon as a hole is centered, the operator enters a "drill down" command on the recording tape. The operator then proceeds to each hole by following a colored path previously marked on the guide. To check the accuracy of the program, the operator reruns the tape checking the programmer to verify that all programmed holes fall within the tolerance circle on the viewing screen.

Playback for the drilling machine is four times its programming rate.

The joy stick is a velocity control having an exponential response such that relatively large movements from its vertical position produce slow movements on the drill table. This design makes precise control easy for the operator. Maximum speed of 100 inches per minute is obtained when the joy stick is moved near to the limit of its range.

The optical comparator is of standard design. However, unlike conventional comparators, the image is focused on the screen by moving the lens back and forth rather than the part or viewing slide.

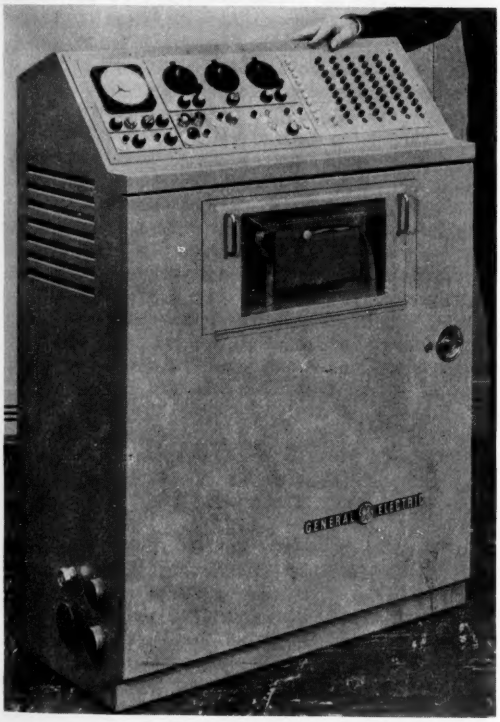
First installation of the new automatic high-speed circuit board drilling machine has been made at the AC Spark Plug Division of General Motors in Milwaukee.

IMPROVED NUMERICAL CONTROL FOR AUTOMATIC CONTOURING WITH METAL-WORKING MACHINES

General Electric
Specialty Control Department
Waynesboro, Va.

A numerical control system for metal-working machines which will make punched-tape programming as simple and economical for contouring operations as for standard positioning has been developed. This system is called the General Electric Mark Century Numerical Control.

At present, programming a typical contouring job requires a medium-sized computer to interpolate curves into thousands of positioning coordinates, which are then recorded on the programming input. Yet most continuous-path machining consists of simple slopes or arcs of circles. The new control has a built-in capacity to order these slopes and arcs without need for detailed, point-to-point programming instructions.



For parts involving only straight cuts, slopes, and arcs of circles, a control program may be prepared directly from specifications on engineering drawings, ready for a typist to punch the coded program using a standard tape-perforating typewriter.

Later models of the numerical control will provide also for standard numerical positioning to absolute coordinates, and combinations of positioning and contouring.

All the electrical circuits incorporate printed circuit boards in standard plug-in modules, promptly removable and replaceable for easier maintenance.

$ 1.3 MILLION FOR PROGRAMMING FOR AUTOMATIC AIR TRAFFIC CONTROL

System Development Corp.
2500 Colorado Ave.
Santa Monica, Calif.

This company (SDC) has signed a $1.3 million dollar sub-contract with the MITRE Corporation for the preparation of special SAGE (Semi-Automatic Ground Environment) computer programs to be used for advanced experimentation on automatic air traffic control.

The computer programs which SDC will design and produce incorporate elaborate new procedures for: automatic decoding and error-checking of flight-plan messages; new logics for air surveillance; and special, flexible, all-purpose, conflict-detection schemes to sense and warn of any unsafe miss-distances between aircraft.

Last year, the MITRE Corporation, of Lexington, Mass., signed a six million dollar contract with the Federal Aviation Agency to design an experimental semi-automatic en-route air traffic control system using current air-defense SAGE facilities. The MITRE contract is one of the largest FAA has entered into in the field of research. The project will be carried out in cooperation with the Department of Defense and the United States Air Force.

WORLD'S LARGEST RADIO TELESCOPE TO IMPROVE ACCURACY OF ASTRONOMICAL MEASUREMENTS 10 TIMES

Developmental Engineering Corporation
Leesburg, Va.

The world's largest radio-radar telescope, powerful enough to detect an object about 3 feet square at a distance of 22,000 miles, is expected to improve the accuracy of astronomical measurement by at least ten times. The initial contract was signed recently. Cornell University is prime contractor with the Advanced Research Projects Agency. The telescope will be built for the U. S. Air Force Research Division near Arecibo, Puerto Rico. Four contractors including this company (Developmental Engrg. Corp.) are engaged in the design.

Expected to be in operation by June or July 1961, the telescope will measure characteristics of the ionosphere (which space vehicles will have to pass through) and the planets. It will also pick up radio signals generated by planets as far as Jupiter (400 million miles).

Ionospheric measurements will include electron density, electron temperature, ionospheric motion, the strength of the earth's magnetic field, etc.

The radar will also investigate the nature of the moon's surface and the sun's surface, and the following characteristics of the planets: rotation size and distance from earth, of Venus, Mars, Jupiter and Mercury, as well as the surface of Venus and Mars and the atmosphere of Mercury and Jupiter.

The reflector portion of the radio telescope will have a diameter of 1000 feet. The largest fully steerable radar currently in operation (Jodrell Bank, England) has a 250-foot reflector. The super radar will operate on about 400 megacycles at peak power of two and a half million watts. Its spherical reflector will be built into a natural limestone bowl 350 feet deep and 1500 feet in diameter.

The probe's scanning capability is provided by a mobile feed section which will be able to swing 20 degrees down from the vertical and will rotate 360 degrees in azimuth or direction. The reflector itself will be stationary. Scanning with conventional antennas requires movement of the entire structure.

The 500-ton feed support system will be suspended by cables 435 feet above the bottom of the reflector. The cables will be supported by three re-inforced concrete towers approximately 250 feet high, equally spaced around the edge of the "dish."

1000 CHARACTERS PER SECOND READ BY PUNCHED TAPE READER

Information Systems Inc. (Genesys)
10131 National Blvd.
Los Angeles 34, Calif.

Up to 1,000 characters per second can be read by a new high speed tape reader. Its name is the Elliott Punched Tape Reader, made in England, and available from Information Systems Inc.

The tape reader reads all standard 5, 6, 7 and 8 hole punched paper tape. Characters are sensed by solid state photo-electric elements, which may be easily replaced or adjusted.

The tape is drawn through by a pair of rollers. The upper roller is fixed on the end of a motor shaft. The position of the lower roller is controlled by an electromagnet. The tape passes between two flat surfaces, the pressure between these being controlled by a second electromagnet. This provides a braking action on the tape, which always overrides the action of the driving rollers. The tape reader is complete with lamp, driving motor, electromagnets and optical system. Speed is completely variable up to 1,000 characters per second, and is under computer control at all times. The reader can be stopped before each succeeding character over the entire speed range. The unit weighs 15 pounds; its overall dimensions are 10 3/4" x 8 1/4".

SOME EFFECTS OF THE CHANGE FROM AIRCRAFT TO MISSILES

W. E. Zisch
Vice President and General Manager
Aerojet General Corp.
a Subsidiary of General Tire and Rubber Co.
Azusa, Calif.

(Excerpts from a talk in Los Angeles in July)

.... To point up for you what has happened in the last six or seven years let me point out that in 1953 the aircraft industry in the United States produced 11,000 planes for the military services. Since then, there has been a steady decline in output to an

estimated 2,200 this year. Unless there is a significant change in the present B-70 program and considerable increases in military cargo plane requirements, the overall decline probably will continue.

What this means in terms of employment can be dramatically exemplified by the fact that in April 1957 the aircraft industry was the largest manufacturing employer in the United States, with 909,000 on the payroll, of whom 602,000 were productive workers.

In March 1960, total employment had dropped to 680,000 and production workers to 407,000.

Interestingly enough, the industry's yearly payroll has stayed virtually constant at about $5.25 billion.

What has been happening, of course, is that the industry has been turning from aircraft to missiles, and while it has fewer employees numerically, they are of a higher caliber and salary. For instance, 35 leading companies in the Aerospace Industries Association had on their payrolls 18,000 salaried professional engineering and scientific personnel in 1950. By 1955 this number had increased to 55,000 and today stands at nearly 99,000.

Ten years ago the ratio of engineers to production workers was 1 to 11. Today it is 1 to 4. These figures reflect better than words what is happening as scientific missilery takes over from standardized aircraft production. The changes which have taken place are:

a) Research and development is up sharply and demands scientific and technological personnel of the highest caliber.

b) Production, in the sense of mass manufacture of components and their ready assembly by production-line methods, is down sharply.

The effect of these radical shifts in emphasis throughout the industry is that any company that wants to maintain a front-running position must mobilize the best engineering, managerial and scientific personnel. It must also maintain somewhere a detached, long-range planning group whose thinking must be completely disassociated from the day-to-day activities of the company. .....

FIRST COMMERCIALLY AVAILABLE IBM 7090 COMPUTER IN A COMPUTER SERVICE ORGANIZATION

C-E-I-R, Inc.
1200 Jefferson Davis Highway
Arlington 2, Va.

A high-speed IBM 7090 electronic computer began operating on August 2 at the Arlington Research Center of this company, one of the largest independent research and computer service firms in the United States.

The 7090 data processing system is the 13th delivered by International Business Machines Corp; it is the first commercial installation in the country to provide both computer time and programming services to both commercial and government users on an hourly or job basis. The first 12 systems are being used exclusively for defense purposes.

It is expected that time on the new computer will be divided about equally between government and commercial users. The increased speed of the 7090 will result in the solution of problems at a significantly lower cost than ever before; it will bring the advantages of electronic computation and data processing within the financial means of many more organizations and firms.

A second IBM 7090 computer will be installed in this company's New York Research Center in the new Union Carbide Building, New York, N. Y., in September.

RESEARCH AND INVESTIGATION OF DRUGS AND CHEMICALS AIDED BY COMPUTER

Burroughs Corp.
6071 Second Ave.
Detroit, Mich.

The miraculous implications of biochemistry...antibiotics which tame deadly microbes, cortical hormones that allay crippling rheumatic diseases, pharmaceuticals which promise to reverse the chemistry of mental illness... promise a pharmaceutical cornucopia in the future.

Schering Corporation, one of the nation's leading ethical drug houses, is using a Burroughs 205 to study the behavior of rats, monkeys, and men. The same computer is also keeping tabs on hundreds of drugs, monitoring inventories and reporting sales activity.

Schering is backing a marathon of experimentation. Research is progressing in many areas of chemical, biological and medical interest. Some 450 scientists and technicians, representing almost every scientific discipline from chemistry to statistics, are working in Schering laboratories.

Using modern analytical instruments, Schering scientists are probing new areas of knowledge involving lever-pushing responses of rats, monkeys, and humans.

The object of this activity is to achieve new and improved drugs to eliminate or alleviate disease. But the job of evaluation becomes more efficient as the fund of basic information is developed.

Therefore, Schering's intensive experimentation has a twofold purpose: 1) to develop increased bodies of information about basic behavior and 2) to test specific effects of drugs on behavior, of rats and other animals.

To 104 rats at Schering, this research has become a way of life. Throughout their existence, the rats live and work on turntables of wedge-shaped cages. Night and day, each rat takes his turn at a work station where he is confronted by two levers. At the end of every half hour, the table rotates and the next rat takes over.

Successful completion of an assigned task by the rat gains him a reward of drinking water. Unsuccessful attempts may result in a postponement of the reward. Peak proficiency is usually reached within three weeks of training.

What the rats have learned is how to count and estimate time. It may be, for example, that lever "A" is to be pushed six times; after which, lever "B" is to be pushed once. Or, lever "A" is to be pushed once; then, after an interval of four seconds -- but no sooner -- lever "B" is to be pushed. There are about a dozen such tests. The accuracy, speed, and consistency of the rats' performance are examined.

Rats can learn complex performances with only 10 or 20 hours of training. The explanation lies in the use of good motivation, immediate reward for the desired behavior, and small increments in the difficulty of the required performance.

Although a basic framework of knowledge is still being compiled in this young field of psychopharmacology, laboratory analysis of behavior is receiving increasing acceptance.

Taking advantage of such information, Schering scientists are able to learn quite a lot about a given chemical compound and its effect on behavior.

Suppose, for example, that a particular compound is being considered as a possible pharmaceutical agent. From experience, behavioral scientists know what behavior to expect of their rats in an undrugged state. They can, therefore, study the compound by measuring its effects on the force, frequency and rate of response, and general organization of the rats' behavior.

Chances are quite slim that the tested compound will ever achieve product status. Most likely, it will either be ineffective or cause undesirable side effects. Of the hundreds of drugs tested each year, most are discontinued before leaving the animal research stage.

"Our present work would be impossible," says Dr. Mechner of Schering, "without the aid of high-speed electronic data processing. Our Burroughs 205 turns out statistical results in seconds that would take months to compute by hand." "In behavioral research alone," says Schering President Francis Brown, "the Burroughs 205 has multiplied productivity one hundred times."

The system works like this. Data from the lever pushings are recorded electronically and transcribed on magnetic tape; this tape is processed by a special-purpose computer built to the specifications of the Schering Behavior Laboratory staff. The computer performs various data analyses preliminary to the more elaborate ones carried out by the Burroughs 205.

Output from the special-purpose computer is in the form of punched cards. These are read into the 205 via the card reader. The 205's final output, from which the behavioral effects of drugs are evaluated, is in the form of tables and graphs.

For the most part, data coming to the 205 can be analyzed and processed with prestored subroutines. This means that a new program doesn't have to be written for every experiment. Rather, the various subroutines are linked together as required.

The 205 prints out on either the Flexowriter or a conventional tabulator. Printout in the form of tables and graphs serves as a final document which goes back to the research laboratory for evaluation.

WHY A *SMALL* COMPUTER?

George A. Hedden, Jr.
Sales Manager
Briggs Associates, Inc.
Norristown, Pa.

About 15 years ago we saw automatic computers for the first time and we have studied the development of this new science with increasing excitement.

However, its evolution has been largely directed by an academic group of logical designers, engineers, programmers and mathematicians whose efforts have been concentrated on computers incorporating higher speeds, larger memory capacities and more extensive input-output peripheral equipment. This burgeoning development, although vitally needed, has produced more and more sophisticated (and expensive) equipment at the expense of the needed development of the small computer.

An analysis of the price ranges of computing equipment on the market today shows a substantial amount of capital invested in desk type calculators which have an upper price limit approximating $1,000 per calculator.

Another substantial amount is invested by users of digital computers starting at approximately $50,000 per unit and extending sharply upward.

The void that exists between the $1,000 units and the $50,000 units is readily apparent and is the topic of this article.

Developing a Small Computer

Before developing a small computer, as with any other product, many factors should be taken into account and carefully studied to be sure that it will fulfill the needs of those desiring this equipment. Major factors included in such an analysis are: The applications to be handled; the types of organizations to be served; and the general features to be incorporated into the design.

Some of the conclusions reached, together with significant reasons, are shown below.

1. A small computer should be first and foremost **general-purpose** and **low in cost.**

The general-purpose nature of the computer permits wide use for different applications and by different types of companies. With a large potential market, the small computer can then be produced on a volume basis, and hence priced within the range of even the smallest budget.

2. A small computer, to be economical for the user, **must be operable by his present non-technical personnel.**

Simplicity of operation is a very important factor to be included in the design of a small computer. It would be uneconomical for a company installing a low-cost computer to have to invest additional time and money in hiring and training specialized computer personnel to operate and program the computer.

The instructions to the computer should be in a form easily understood by the average high school graduate; the operating procedures and programming techniques should be straightforward and easy to learn. Although ease of operation is paramount, the logic available should be such as to be able to perform highly complex calculations where necessary.

Ease of operation is not the only facet of simplicity to be taken into account. The design should also incorporate the most desirable, advanced, proven developments in the "state-of-the-art" regarding hardware, e.g. transistors, and must be such that it can be readily serviced, both for repair and for preventive maintenance. In this way, the user will realize greater savings because of the increased productive hours of the installation.

3. Included in the concept of design simplicity is the practicability of installation of a computer. To be truly economical, a small computer should require no additional investment by the user for such site modifications as air conditioning, floor bracing or increased-power electrical outlets. The computer should be flexible as regards its portability so that it can be easily moved from location to location.

4. A small computer must, however, possess other basic qualifications. It must:

- Accept input information efficiently, directly, from the operator.
- Accept input information from standard commercially available equipment.
- Perform all arithmetical functions: add, subtract, multiply and divide.
- Compare numbers and alter the sequence of operations depending upon the results of this comparison.
- Compute through subroutines such standard mathematical functions as exp, sin, log, cos, tan, arctan, involution, evolution, etc.
- Perform operations manually with speed and ease.
- Perform operations automatically under program control.
- Compute with words large enough to provide results of the required accuracy.
- Scale computations (decimal point) automatically for operating ease and/or with the flexibility desired for more sophisticated programs.
- Automatically accumulate totals for proof, updating, etc.
- Quickly provide results of computation in final form.
- Perform computations with a minimum of operator intervention and supervision.
- Perform at high degrees of speed, accuracy and reliability for long periods of time with a minimum of preventive maintenance.

The general-purpose nature and the low price discussed above make the small computer appropriate to

almost any size organization where computation is a part of its activities.

Types of Organizations to Use a Small Computer

Small companies, of course, have a most obvious need because they usually have neither the capital nor work load to justify the expense of larger equipment. The flexibility of the general-purpose small computer allows it to be used for all of the company's computing work from payroll to scientific calculations.

Medium-size companies have one area in particular most appropriate for large saving of expense through the use of a small general purpose computer, namely, where computing work is performed by a staff of operators using desk calculators. The small computer not only performs these calculations faster and more economically, but produces the results in final form, avoiding transcription hazards and expense.

Large companies, even those with large-scale computer installations, can use a small computer for a supplement to their large-scale installation, for decentralized operations, and for those operations where total elapsed time is important. All too frequently there is much small-volume work which can be done on large-scale computers, but they are operated on a tight production schedule. This small-volume work therefore suffers through its inability to be included on the production schedule when needed.

Applications for Small Computers

Three general spheres of applications are scientific, data processing, and instrumentation and control applications.

In **scientific applications,** the small computer is very useful as a personal tool to the engineer, scientist or mathematician, and it has special value in the area of research. Here he can set up problems and perform otherwise tedious calculations automatically and more economically than would be possible using desk calculators or larger scale computers. Trial sets of parameters for a particular design problem can be evaluated until an optimum is reached.

Because he can manually enter data or change the program, the engineer, scientist or mathematician can alter parameters or even the equation itself very easily. No time is spent preparing data in machine code, which is expensive if not reused, and very little time is spent on programming. The direct accessibility of the small computer and its ability to give answers immediately in their final form are what makes it ideally suited to calculations on an experimental basis.

The small computer can supplement a larger scientific computer installation in many ways. For instance, it can check out portions of the large computer's program to make sure of the accuracy of the method of solution and programming. It is often more economical to carry out "debugging" functions on a small computer than to use large-scale computer time, thus leaving it free for the "production" jobs.

If a computer is used for many short-run problems, it frequently is more economical to program them on a small computer. Preparatory data such as tables for a large computer program may be prepared by the small computer with a machine-coded output device.

Other applications which are more economically run on a small computer are, for the most part, applications in which programming the larger computer takes a proportionately large amount of the total time consumed. Also, there are applications requiring the preparation of data in machine-coded language on a once-used basis.

In the area of **data processing applications,** the small general-purpose computer is best suited to a small company's operations in payroll and invoice extensions in addition to other computing work. The small computer usually does not have all the "paper handling" peripheral equipment nor the storage capacity of a large-scale data processing system needed for large volume work. Yet for those companies which cannot afford these large systems because their work load does not warrant them, the small computer fills the bill well.

Even in data processing in large companies, a very important application of a small computer is as a part of a decentralized data processing system. Each branch, division, department or regional office is in itself relatively small, and has in turn a limited budget. A small computer which is priced low enough to be within range of their budget can be used to perform their computations completely or up to a point where intermediate results can be **automatically** recorded in a common machine-language, e.g. paper tape. These results can then be sent to the central office for final processing by its larger scale equipment without intervening expensive, delaying and error-producing steps of manually converting data to machine coded language.

Those who have had experience with decentralized operations can appreciate a very important pair of problems: (1) the training of the outlying operating personnel; (2) the lack of standardized output from each decentralized office. The small computer, because it may be programmed to do most of the work, permits the training to be accomplished with far greater ease and effectiveness. Because the computer automatically carries out specific instructions, the output from all outlying locations may be standardized.

Instrumentation and control applications are very adaptable to the use of a small general-purpose computer. In most cases the problem consists of accepting input data on-line in the form of electrical impulses, making calculations with this data, and producing an output which can be accepted by one of the many digital input devices commercially available. The calculations which can be made include: standard deviations of test data; reduction of test data to a useful form; trial-and-error computations for optimum mixtures; optimum mixtures resulting from economic changes; solutions to process control problems to determine changes needed in the stream of material(s) — in composition, pressure, temperature, tool guidance, etc. With a little imagination one can visualize great possibilities in this relatively new and expanding field.

The key to the economics of a small computer used in instrumentation and control is in its general-purpose nature. Such a computer is adaptable to many different forms of input-output equipment without expensive engineering modifications, because it has the ability to perform computations automatically at high degrees of speed, accuracy, and reliability.

Essential Special Terms in Computers and Data Processing — Suggested List, and Definitions

Part I

(From: Glossary of Terms in Computers and Data Processing, 5th edition of the **Computers and Automation** glossary / Edmund C. Berkeley and Linda L. Lovett / Berkeley Enterprises, Inc., 815 Washington St., Newtonville 60, Mass. / July 1960, 96 pages, photooffset, $3.95 to nonsubscribers, $1.85 to subscribers)

I.

The special terms of any subject are the key to understanding it; the special terms of the field of computers and data processing are accordingly, the key to the understanding of this field.

Among the many special terms in any field of knowledge, there are two kinds: those that are essential, that convey the key ideas of the subject to a person interested in understanding it; and those that are helpful but not essential. An example of the first kind of term in the computer field is "binary notation"; it would be very hard to understand much of the field of computers without knowing the meaning of "binary notation". An example of the second kind of term is "minimum latency programming"; for many purposes it is not necessary to know exactly what this term means, especially since one can guess (correctly) that it means programming which has a certain minimum property.

In this glossary, we have sought to define with particular care the special terms for key ideas. We have tried to define them fully, with sufficient comment and illustrations. See for example the definition of "binary notation"; see also the following brief suggested list of essential special terms expressing key ideas.

In addition to this aim, we have sought to express the definitions for all terms in words that would be clear to a person relatively new to the field, one who did not already have some familiarity with the term he looked up. The main purpose of this glossary, in fact, is to give definitions that can be understood by the user. For example, we object to defining "check digits" as "a check modulo **n**" because anyone who knew the meaning of "a check modulo **n**" would already know almost all the meaning of "check digits".

This glossary contains over 870 terms. . . . . We request all our readers to be kind enough to send us any departures of these definitions from what they find these terms to mean in their experience. . . . . .

II.

Essential Special Terms in the Field of Computers and Data Processing — Suggested List

General Concepts
- Computer
- Analog computer
- Digital computer
- Data processor
- Cybernetics
- Feedback
- Negative feedback
- Positive feedback
- Automatic data processing
- Integrated data processing
- Language

Digital Computers
- Input
- Output
- Memory
- Arithmetic unit
- Control unit
- Address
- Access time
- Random access
- Pulse
- Channel
- Clock
- Transducer
- Card
- Magnetic Tape

Programming
- Information
- Instruction
- Code
- Program
- Transfer instruction
- Pseudo-code
- Automatic programming
- Compiler
- Plugboard

Operation
- Check digits
- Automatic checking
- Computing efficiency
- On-line

Representation of Information
- Digit
- Character
- Notation (scale of notation)
- Binary notation
- Coded decimal
- Biquinary
- Binary digit
- Bit
- Machine language
- Machine word

Mathematics and Logic
- Fixed-point calculation
- Floating-point calculation
- Complement
- Parameter
- Boolean algebra
- AND
- Inclusive OR

NOT
Exclusive OR

III. General Concepts

computer — 1. A machine which is able to calculate or compute, that is, which will perform sequences of reasonable operations with information, mainly arithmetical and logical operations. 2. More generally, any device which can accept information, apply definite reasonable processes to the information and supply the results of these processes. 3. A human being who can perform these operations and processes.

analog computer — A computer which calculates by using physical analogs of the variables. — **Note: Usually** a one-to-one correspondence exists between (1) each numerical variable occurring in the problem and its solution and (2) a varying physical measurement such as voltage or rotation in the analog computer. In other words, an analog computer is a physical system in which the analysis or solution of the problem is mirrored by the varying behavior of the physical system.

digital computer — A computer in which information is represented in discrete form and which calculates using numbers expressed in digits and yeses and noes expressed usually in 1's and 0's, to represent all the variables that occur in a problem.

data processor — A machine for handling information in a sequence of reasonable operations.

cybernetics — 1. The comparative study of the control and the internal communication of information-handling machines and the central nervous systems of animals and men, in order to understand better the functioning of brains and communication. 2. The study of the art of the pilot or steersman.

feedback — The returning of a fraction of the output of a machine, system, or process to the input, to which the fraction is added or subtracted. If increase of input is associated with increase of output, subtracting the returned fraction (negative feedback) results in self-correction or control of the process, while adding it (positive feedback) results in a runaway or out of control process.

negative feedback — The returning of a fraction of the output of a machine, system, or process to the input from which the fraction is subtracted; if increase of input is associated with increase of output, this results in self-correction or control of the machine, system, or process. For example, if an increase of caterpillars is associated with an increase of parasites destroying them, then the caterpillar-parasite populations display negative feedback.

positive feedback — The returning of a fraction of the output of a machine, system, or process to the input to which the fraction is added; if increase of input is associated with increase of output, this results in a runaway or out-of-control process. For example, if an increase of rabbits results in a still further increase of rabbits, the population of rabbits displays a runaway or out-of-control process.

automatic data processing (ADP) — Digital Computers. The processing of information by: (1) obtaining input information in machine language as close to the point of origin as economically possible; (2) operating on the information by automatic computer and other machines, without human intervention, as far as economically justified; and (3) producing just the output information needed. For example, a department store would have attained automatic data processing if: (1) at the time of each sale the details were entered mechanically into the system by a salesperson's plate, a customer's plate, and a merchandise punched ticket; and (2) reports to management, bills to customers, reorders for low inventory, commissions to sales clerks, and other desired output reports were all computed and produced by the system without human intervention. Also called integrated data processing (IDP).

integrated data processing — 1. Data processing organized and carried out in a completely planned and systematic way, without bottlenecks. 2. A group of data processing procedures built around a common machine language, such as punched paper tape, in which there is a minimum of operations by human clerks, such as typing data to go into the system. Abbreviation: IDP.

language — 1. A set or system of symbols used in a more or less uniform way by a number of people so that they may communicate with and understand one another. 2. Electronic Computers. A system consisting of a carefully defined set of characters, rules for combining them into larger units (words or expressions), and specifically assigned meanings used for representing and communicating information or data among a group of people, machines, etc.

[To be continued]

CALENDAR OF COMING EVENTS

Aug. 29-Sept. 3, 1960: 4th International Symposium on Information Theory, London, England.

Sept. 5-10, 1960: Second International Conference on Operational Research, Aix-en-Provence, France; contact John B. Lathrop, Operations Research Div., Lockheed Aircraft Corp., Burbank, Calif.

Sept. 6-8, 1960: Joint Automatic Control Conference, M.I.T., Cambridge, Mass.; contact Harvey A. Miller, Taylor Inst. Co., 95 Ames St., Rochester, N. Y.

Sept. 7-9, 1960: 1st Joint Automatic Control Conference, sponsored by ISA, AIChE, AIEE, ASME, IRE, at Mass. Inst. of Technology, Cambridge, Mass.; contact Dr. James Mozley, Johns Hopkins University, Baltimore, Md.

Sept. 12-16, 1960: Share XV Meeting, Pittsburgh Hilton Hotel, Pittsburgh, Pa.; contact E. B. Weinberger, Gulf Research & Development Co., P. O. Drawer 2038, Pittsburgh 30, Pa.

Sept. 19-21, 1960: 5th Annual Symposium on Space Electronics and Telemetry, sponsored by The Institute of Radio Engineers, Inc., Shoreham Hotel, Washington, D.C.

Sept. 19-21, 1960: International Symposium on Data Transmission, Delft, Netherlands; contact Dr. H. C. A. Van Duuren, Postbus 174, Den Haag, Netherlands.

Sept. 20-24, 1960: Symposium on the Numerical Treatment of Ordinary Differential, Integral and Integro-Differential Equations, University of Rome, Rome, Italy; contact Prof. A. Ghizzetti, Provisional International Computation Ctr., Palazzo degli Uffici, Zona dell'EUR, Rome.

Sept. 22-23, 1960: Fall Meeting of the Univac Users Association, Washington, D.C.; contact W. C. Rockwell, Remington Rand, 315 Park Ave. So., New York 10, N.Y.

Sept. 26-30, 1960: 3rd ISA Instrument-Automation Conference and Exhibit of 1960, and ISA's 15th Annual Meeting, New York Coliseum, New York, N.Y.

Sept. 30-Oct. 1, 1960: Third Annual Northwest Computing Conference, sponsored jointly by the Northwest Computing Association and the Oregon State Board of Higher Education, Portland, Ore.; contact George G. Town, Program Comm. Chairman, Oregon State College, Corvallis, Ore.

Oct. 4-6, 1960: Meeting, Burroughs 220 Computer User Group (CUE), Philadelphia, Pa.; contact Merle D. Courson, First National Bank of San Jose, San Jose, Calif.

Oct. 9-14, 1960: 1960 Fall General Meeting of American Institute of Electrical Engineers, New York, N.Y.; contact Clarke S. Dilkes, Assoc. Dir., Burroughs Corp., Research Ctr., Paoli, Pa.

Oct. 10-12, 1960: National Electronics Conference, Hotel Sherman, Chicago, Ill.; contact Prof. Thomas F. Jones, Jr., NEC Program Chairman, School of Electrical Engrg., Purdue Univ., Lafayette, Ind.

Oct. 10-14, 1960: American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill.

Oct. 17-19, 1960: Symposium on Adaptive Control Systems, sponsored by Long Island Section, Institute of Radio Engineers, Garden City Hotel, Garden City, L.I., N.Y.; contact F. P. Caruthers, Symposium Chairman, c/o Specialties Inc., Skunks Misery Rd., Syosset, N.Y.

Oct. 19-26, 1960: Second Interkama — International Congress and Exhibition for Measuring Techniques and Automation, Düsseldorf, Germany.

Oct. 20-22, 1960: 7th International Meeting of the Institute of Management Sciences, with session "Use of Computers in Simulation," Hotel Roosevelt, New York, N.Y.; contact James Townsend, 30 E. 42 St., New York 17, N.Y.

Oct. 26-27, 1960: The 1960 Computer Applications Symposium, sponsored by Armour Research Foundation of Illinois Institute of Technology, Morrison Hotel, Chicago, Ill.; contact Andrew Ungar, Armour Res. Foundation, 10 W. 35 St., Chicago 16, Ill.

Oct. 31-Nov. 2, 1960: 13th Annual Conference on Elec. Techniques in Medicine and Biology, Sheraton Park Hotel, Washington, D.C.; contact G. N. Webb, Rm. 547, CSB, Johns Hopkins Hosp., Baltimore 5, Md.

Oct. 31 — Nov. 4, 1960: 7th Institute of Electronics in Management, featuring Current Developments in Automatic Data Processing Systems, American University, Washington, D.C.; contact Dr. Lowell H. Hattery, Director, 7th Inst. on Electronics in Management, The American University, 1901 F St., N. W., Washington 6, D.C.

Nov. 5, 1960: Meeting of the Society for Industrial and Applied Mathematics, Univ. of Pennsylvania, Physical Sciences Bldg., 33rd & Chestnut Sts., Philadelphia, Pa.; contact Dean Gillette, Bell Telephone Laboratories, Inc., Whippany, N. J.

December 13-15, 1960: Eastern Joint Computer Conference, New Yorker Hotel, New York City; contact Dr. Nathaniel Rochester, IBM, Yorktown Heights, N.Y.

Jan. 16-19, 1961: ISA Winter Instrument-Automation Conference & Exhibit, conference at Sheraton-Jefferson Hotel, exhibit at Kiel Auditorium, St. Louis, Mo.; contact William H. Kushnick, Exec. Dir., ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

Feb. 15-17, 1961: International Solid State Circuits Conference, Univ. of Pa. and Sheraton Hotel Philadelphia, Pa.; contact Jerome J. Suran, Bldg. 3, Rm. 115, General Electric Co., Syracuse, N. Y.

March 16-17, 1961: Conference on Data Processing Techniques and Systems, sponsored by Numerical Analysis Laboratory at the University of Ariz., featuring "Discussions of data processing problems in engineering and scientific research," Tucson, Ariz.; contact Miss Betty Takvam, Conference Secretary, Numerical Analysis Lab., Univ. of Ariz., Tucson, Ariz.

Mar. 20-23, 1961: IRE International Convention, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.; contact Dr. G. K. Neal, IRE, 1 E. 79 St., New York 21, N. Y.

Data Processing Training in California's Junior Colleges

Part 2

Enoch J. Haga
Stanislaus State College
Turlock, Calif.

(Continued from Computers and Automation, August, 1960, page 21)

BE 86A, Work Experience in Business Data Processing, 2 units, one semester. "The student is required to work five hours per week in a data processing position and to attend one class session a week. . . ."

Math 32A-32B, Introductory Mathematical Analysis for Business, 6 units, two semesters. Some seventy topics are covered, ranging from review of fundamentals to regression lines.

In addition to the degree in BDP, a student may secure the Data Processing Technician Certificate by completing Math 32B, BE 8B, and BE 86A.

Reedley College, Reedley, Calif.

Development of instructional aids for data processing programs was the main objective of experimental work at this college. E. C. Berkeley's *Simple Simon* was found to be the only worthy teaching aid, but use of the machine was thought undesirable because "it performs a modular arithmetic in modulo 4, which should not confuse engineers to whom the machine was originally demonstrated. In an introductory course, however, this unfamiliar arithmetic is very undesirable."

Both of the small commercially available kits were rejected as being too small for classes to see, and because of length of time needed "to change from one logical network to another."

Seven different teaching aids were constructed, four of them to illustrate operations in Boolean algebra. In addition *CO-ED* (Computer for Educational Demonstration) was constructed and demonstrated on May 15, 1959 "at a meeting sponsored by the California Bureau of Business Education" held in San Francisco. Plans are available for the *CO-ED* and the parts list indicates that the machine can be built for $68.30. All of the above teaching aids were actually used in a three unit course, Mathematics 40, Introduction to Digital Computers.

Stockton College, Stockton, Calif.

Stockton College has prepared a suggested two-year curriculum leading to the A.A. degree. Data processing offerings include Business Machines Functions, three units; Business Data Processing, three units; Machine Programming, four units; Logic of Data Processing, six units; Computers — Stored Programming, three units; plus related courses and two units of work experience. The first course offered in the new data processing curriculum, Fundamentals of Business Data Processing, included description of basic equipment, terminology, coding, cards, principles of punched card accounting, progress of data from the source document to the output, calculators and computers, speeds of the various kinds of machines, field trips to installations, functional wiring, model selector, introduction to stored programming, principles of computer language, system development, principles of flow charting, and various applications. Case studies and guest speakers were included in the course.

Summary

In California, under the impetus of the National Defense Education Act of 1958, courses and curriculums in data processing have been and are being set up. The junior college seems to be emerging as the place where data processing technicians receive their training — insofar as public schools train technicians for this field at all. It is now possible for students in some areas of California to major or specialize in a data processing curriculum leading to the A.A. degree. The curriculum seems to consist usually of some type of an introductory course, followed by a sequence of accounting, mathematics, business, economics, punched card, and data processing courses. Data processing appears to include punched card equipment, so the new BDP curriculums do not seem to be emphasizing strictly *electronic* data processing. A *CO-ED* computer has been built especially for classroom use.

These pioneering efforts of our junior colleges may be expected to blossom and expand greatly in the years to come. Data processing is finally being introduced into our public schools; it is only fair to say that without government financial aid, this rapid expansion of the data processing curriculum would not be possible.

Sources

A Descriptive Report of Business Data Processing in Technical Business Education for the School Year 1958-59. Bureau of Business Education, Division of Instruction, California State Department of Education, Sacramento 14, California, September 1959. Ten pages, mimeographed.

A Technical Training Program in Business Data Processing for Business Data Processing for Junior Colleges. Report of a study coordinated by Louis J. Gentile, Chaffey College, Ontario, California, June 29, 1959. Twenty-five pages, mimeographed.

Business Data Processing. A study to determine what changes in or additions to the subject matter should be made that the Business Curriculum of our junior colleges may be current with the technological changes in office operations, for the Contra Costa Junior College District, Martinez, California, at Diablo Valley College, Concord, California; study undertaken February 2, 1959 and report submitted June 15, 1959. R

search and report by Doris Thomas. Seventy-six pages, mimeographed.

A Program for Training Computer Programming Technicians. Report of a pilot study made at Foothill College, 150 El Camino Real, Mountain View, California, June 1959. Prepared by Walter E. Wiebenson. Twenty-five pages, plastic bound, with recruitment brochure insert.

Business Data Processing. Project Director, John J. Dufour. Orange Coast College, Costa Mesa, California, June 30, 1959. One hundred fifty-four pages, mimeographed, plastic bound, with recruitment brochure insert; contains 12 illustrations.

Progress Report of Phase I of a Project in Experimentation in Equipment and Facilities for Teaching Basic Concepts of Electronic Digital Computers. By Kenneth P. Swallow, Reedley Joint Union High School District, Reedley, California, June 30, 1959. Eight pages, ditto process. Contains plans for *CO-ED* computer with parts list.

A Progress Report for the Year Ending June 30, 1959 on Courses for Technicians in Business Data Processing. Stockton College, 3301 Kensington Way, operated by the Stockton Unified School District, 701 N. Madison Street, Stockton, California. Eleven pages, mimeographed.

WHO'S WHO IN THE COMPUTER FIELD — ENTRY FORM

If you are interested in the computer field, please fill in and send us the following Who's Who Entry Form (to avoid tearing the magazine, the form may be copied on any piece of paper).

Name? (please print) ....

Your Address? ....

Your Organization? ....

Its Address? ....

Your Title? ....

Your Main Computer Interests?

( ) Applications
( ) Business
( ) Construction
( ) Design
( ) Electronics
( ) Logic
( ) Mathematics
( ) Programming
( ) Sales
( ) Other (specify):

....

....

Year of birth? ....

College or last school? ....

Year entered the computer field? ....

Occupation? ....

Anything else? (publications, distinctions, etc.) ....

....

Readers' and Editor's Forum

FRONT COVER: FIRST INTERNATIONAL CONFERENCE ON AUTOMATIC CONTROL IN MOSCOW, U.S.S.R.

The front cover shows a two-photograph view of the assembly hall of the Lomonov State University in Moscow, U.S.S.R., filled with persons attending the First International Conference on Automatic Control, the conference took place June 27 to July 2, 1960. A report on this conference will be given at Kresge Main Auditorium, Mass. Inst. of Technology, Cambridge 38, Mass., on Thursday, Sept. 8, at 8:00 p.m. The speakers will be Harold Chestnut, (of General Electric), first president of the International Federation on Automatic Control, and other automatic control specialists. They will also report on technical developments observed at the time of the conference, and give an analysis of present status and future trends in automatic control theory, scientific and industrial applications, and control system components.

HIGH-SPEED DATA TRANSMISSION GROUP ORGANIZED IN CALIFORNIA

Representatives of seven major Southern California companies in the aerospace industry have formed a private study group to investigate their common requirements for high-speed data transmission (10 thousand to 1 million bits per second), and acquisition of data from sources. Several of the companies had previously taken independent steps in these areas. Initially the group will focus on high-speed transmission only.

Objectives of the group will be discussion of a total system approach to data communication problems, development of reasonably uniform requirements for equipment and service, and forecasting of long-range needs. Jack A. Strong, Administrator of Integrated Data Processing, North American Aviation, was elected chairman; and Justin A. Perlman, Assistant to the Director of Corporate Industrial Dynamics, Hughes Aircraft Company, was elected secretary.

CORRECTION — ALWAC COMPUTER DIVISION OF EL-TRONICS EXPANDING

Phil Jarvie
Al-Wac Computer Division
El-Tronics,
Hawthorne, Calif.

Concerning your "Computer Census as of January 1960" article appearing in your July, 1960 issue, Vol. 9, No. 7, we should like to make the following comments:

1. The ALWAC Computer Division of El-Tronics, Inc. is in no way withdrawing from the computer field.
2. The ALWAC Computer Division of El-Tronics Inc. has at present more than 40 users with more installations scheduled in the year.
3. Some pending installations are to receive advanced versions of ALWAC computers. (We have not yet announced our new computer.)
4. You may be aware of the changes which have taken place in the corporate structure of El-Tronics, Inc.; these changes point to the growth of El-Tronics in the computer field.

We at the ALWAC Division cannot emphasize too strongly our current activity of expanding in the computer field, and we hope that you understand our feelings when we see in your fine publication an indication of the opposite, our "withdrawal" from this field. We should like very much to see, instead, a note concerning our increased activity in the field.

Industrialist Stuart J. Myers announced on July 18, 1960, that another step toward the re-organization of El-Tronics, Inc. has been accomplished. As an aid to consummation, 3 1/2 million dollars of assets have been transferred to El-Tronics, Inc. from six of Myers' Corporations and eight new operating divisions will continue to do business in the same manner and under the same management as they have had under the Myers' Corporations. Both the Federal Court and the Securities Exchange Commission have approved this step even though final consummation of the re-organization may not take place until September.

The ten operating divisions of El-Tronics, Inc. are as follows:

ALWAC Computer Division — Hawthorne, California
Bond Electric Division — Clarendon, Pennsylvania
Certified Electric Division — Warren, Pennsylvania
Great Western Fuse Division — Jamestown, New York
Interlectric Division — Warren, Pennsylvania
Monarch Electric Division — Jamestown. New York
Nu-Lite Division — Newark, New Jersey
Solar Electric Division — Warren, Pennsylvania
Sunray Products Division — Warren, Pennsylvania
Warren Components Division — Warren, Pennsylvania

This transfer puts El-Tronics, Inc. in a sound financial condition and in a position to continue on a profitable operating basis.

For the ALWAC Division in the Hawthorne area, this offers the advantage of a larger corporate structure, and increased opportunity for profitable growth and greater employment.

COMPUTER PROGRAMMING COURSES AT SANTA MONICA CITY COLLEGE

Elmer M. Krehbel

Director, Evening
Santa Monica City College,
Santa Monica, Calif.

We should appreciate your bringing the following information to your readers. Santa Monica City College will offer four classes in computer programming in its evening program for the fall semester. Classes will begin September 12, 1960. The classes to be offered are as follows:

Math 709A / Digital Computer Programming, Beginning for IBM-709/7090 / Instructor: Jack Little, Rand Corp. / 7-10 p.m., Thursday evenings.

Math 709B / Digital Computer Programming, Intermediate for IBM-709/7090 / Instructor: Wayne Shelton, Rand Corp. / 7-10 p.m., Tuesday evenings.

Math 7070A / Digital Computer Programming, Beginning for IBM 7070 / Instructor: Paul Rubin, System Devt. Corp. / 7-10 p.m., Monday evenings.

Math 7070B / Digital Computer Programming, Intermediate for the IBM-7070 / Instructor: Paul Rubin, System Devt. Corp. / 7-10 p.m., Wednesday evenings.

Further information concerning these classes may be obtained from the Evening Director's office (Exbrook 97711 - Ext 215) or from the instructors.

COMPUTER OPERATION, MODE "FULL SPEED AHEAD AND . . . ."

"He doesn't know how to work it, but I like his confidence."

SURVEY OF RECENT ARTICLES

Moses M. Berlin
Cambridge, Mass.

We publish here a survey of articles related to computers and data processors, and their applications and implications, occurring in certain magazines. We seek to cover at least the following magazines:

For each article, we shall publish: the title of the article / the name of the author(s) / the magazine and issue where it appears / the publisher's name and address / two or three sentences telling what the article is about.

Semiconductors / Business Week Staff / Business Week, March 26, 1960, p. 74 / McGraw-Hill Publishing Co., Inc., 330 W 42nd St., N. Y. 36, N. Y.

This special report by **Business Week** reports on transistors and semi-conductors — the "semi-conductor industry"; their invention and development; some of the people responsible for their development; and the rapidly expanding business of their manufacture, including 90-odd companies with annual sales of $500 million.

Can the Computer Supplant the Clinician? / Wayne H. Holtzman, Univ. of Texas / Journal of Clinical Psychology, no. 16, 1960, p.119 /

A computer can, with the aid of the clinician's "experience and intuition", be used to collect: routine data, i.e., biographical details; to process test protocols; and to make certain types of interpretations based on actual predictions. A program written for an IBM 650 in connection with this application of data processing, is described.

A Successful Venture in Computer Sharing / staff-written / Management & Business Automation, vol. 3, no. 4, May, 1960, p.30 / The Office Appliance Co., 600 W. Jackson Blvd., Chicago 6, Ill.

This article describes a successful computer - sharing establishment called "SPAN", which makes it possible for medium-sized firms to make use of data processing in a practical manner. Four insurance companies, in Hartford, Conn., Springfield Fire and Marine, Phoenix, Aetna and National Insurance, devised a cost-sharing plan and used jointly an IBM 705 for accounting, and collating large amounts of data.

A Review of Feature Articles — How "Instruments and Control Systems" Covered Digital Computation during 1956-1959. / Instruments Publishing Co., 845 Ridge Ave., Pittsburgh 12, Pa. / 1960?, photooffset, 9 pp, free.

A report on articles on the subject of digital computers published in **Instruments and Control Systems,** during the years 1956 to 1959, is presented. The list covers articles Jan., 1959 through Dec., 1959, then Jan., 1958, to Dec. 1958, and so on. Each entry consists of title, a brief descriptive statement, and month of publication. Authors are not stated.

Computer Installation Speeds Saturn Space Project / Nilo Lindgren / Electronics, vol. 33, no. 27, July 1, 1960, p.28 / McGraw Hill Publishing Co., Inc., 330 West 42 St., New York 36, N. Y.

The use of various computers in all phases of the Saturn Space Project is discussed. The evaluation of test firing data is made rapid and accurate by the large computational center. Also the computer to be used in the guidance system is described.

The Computer Bulletin, Dec. 1959, vol. 3, nos. 3-4 / British Computer Society Ltd., Finsbury Ct., Finsbury Pavement, London, E. C. 2 / 1959, printed, 92 pp, 5 shillings.

Published quarterly, the bulletin is a supplement to "The Computer Journal". This issue presents the Society's annual report; a report on the International Conference on Information Processing, 1959; five brief articles on computers and programming; book reviews; and industry news notes.

Character Generator for Digital Computers / Earl D. Jones, Stamford Res. Inst. / Electronics, vol. 33, no. 7, Feb. 12, 1960, p.117 / McGraw-Hill Publg. Co., Inc., 330 West 42 St., New York 36, N. Y.

Generally, the speed at which a computer passes information to a person is slower than computer speed. This article describes a monoscope tube which helps increase the speed with which information can be passed from a computer to a person.

Analysis of Time-Sharing in Digital Computers / Roger L. Boyell / Journal of the Society for Industrial and Applied Mathematics, vol. 8, no. 1, March, 1960, pp 102-24 / S. I. A. M., Box 7541, Philadelphia 1, Pa.

A computer with "time-sharing" facilities can search its memory for particular records while simultaneously performing calculations. This paper presents an analytic discussion of internal computer time-sharing using machines with sequential-access memories, e.g. magnetic tapes, as models. The author discusses a specific mathematical model to demonstrate the method of analysis. The method is then expanded to describe the general case, and this can be modified and applied to new problems and various machines.

Semiconductor Networks for Microelectronics / Jay W. Lathrop, Richard E. Lee, and Charles H. Phipps / Electronics, vol. 33, no. 20, May 13, 1960, p. 69 / McGraw-Hill Pub. Co., 330 West 42 St., New York 36, N. Y.

Computer circuitry can be designed from microminiature semiconductors, which improve reliability as well as allow for reduction in size. A process of selective diffusion and shaping is discussed, and the development of an entire circuit network from diagram to solid circuit network is described.

BOOKS
and
OTHER
PUBLICATIONS

Moses M. Berlin
Cambridge, Mass.

WE PUBLISH HERE citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning Computers and Automation.

Salmon, L. J. / The ABC's of IBM Machine Operation / International Tabulating Inst., 101 South Vermont Ave., Los Angeles 4, Calif. / 1959, photo-offset 92 pp, $5.00.

This manual-textbook for people new in the field thoroughly discusses the operation of IBM punched card machines, with particular emphasis on commercial applications. In twelve chapters the author describes: the IBM card; key punches; reproducers, accounting machines; sorters; collators; interpreters; and calculators. A "Summary and Miscellany" are included. The next edition will contain an index; this one does not have one.

Gille, Frank H. and others / The Punched Card Data Processing Annual, Applications and Reference Guide 1 / Gille Associates, Inc., Maccabees Bldg. 956, Detroit 2, Mich. / 1959, printed, 240 pp, $15.00

This book is an issue of an annually published reference manual. It contains a computer guide, with a one page description including picture of principal models of computing equipment, and also brief statistics on their capacity and operation; many descriptions however are scanty. Also, there are over 40 articles and descriptions of various business applications of computing systems, including, for example, sales analysis, inventory, invoicing, and similar business subjects. There is an 11 page section on verified wiring tips and techniques applying to punch card machine wiring. A 19 page directory of "Local Sources of Data Processing Supplies and Services" is provided; it is classified first under about 40 cities ranging from Albany, N. Y. to Youngstown, Ohio, and second under three subheadings, Filing and Storage Equipment, Service Organizations, and Paper Forms. The book in its field is undoubtedly useful and valuable.

Proceedings of the International Conference on Scientific Information / Printing and Publishing Office, National Academy of Sciences & National Research Council, 2101 Constitution Ave., Washington 25, D.C. / 1960, printed, 1635 pp (two volumes), $20.00

Complete texts of the 75 papers dealing with informational needs of scientists and with systems for the storage and retrieval of such information, are included; also there are 200 additional pages of discussion and summary. Some of the seven areas of discussion are: Literature and Reference; Needs of Scientists; The Function and Effectiveness of Abstracting and Indexing Services; and Responsibility of Government, Professional Societies, Universities, and Industry for Improved Information Services and Information. Subject indexes are included for each volume.

Irwin, Wayne C. / Digital Computer Principles / D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. / 1960, printed, 321 pp, $8.00

The person with no previous experience or familiarity with computers will find this book and excellent introduction. The book first explains the methods of computation, the binary system, and the fundamental arithmetic operations; then it continues discussing digital computers and programming techniques. Circuitry is explained with the help of diagrams. The book contains eleven sections, including one on "Present Trends". A bibliography and index are included.

Bukstein, E. / Digital Counters and Computers / Technical Div., Rinehart & Co., 232 Madison Ave., New York 16, N. Y. / 1960, printed, 248 pp, $7.00

The subject of computer technology is discussed in this book, from two distinct, though related, points of view: electronic circuitry, where the author explains "flip-flop" circuits, logic and switching circuits; and number theories and counting systems with which a computer calculates. An appendix to the text includes diagrams and descriptions of circuitry used in computers and digital counters. Indexed.

Agnew, Ralph Palmer / Differential Equations, 2nd Edition / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 485 pp, $7.50

The subject matter of this book is presented in a manner which makes the text useful as a textbook for a course on differential equations, and as a reference for those with a knowledge of algebra, trigonometry and elementary calculus. In sixteen chapters, the author presents clearly, information on linear equations of first order, Laplace transforms, Fourier series, Picard's method, and, existence theorems for equations of higher order and for systems of equations. The "heat equation" and the use of series are discussed. An index is included.

Auger, Raymond W. / The Relay Guide. A Compendium of Electro-mechanical Relays Marketed in the United States / Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. / 1960, offset, 383 pp, cost ?

Descriptions and information are provided for nearly 1000 types of relays marketed in the U. S. Each of the chapters, arranged according to specialization, i.e., General Purpose, Special Purpose, is alphabetically organized according to the manufacturer's name. There are four appendices, one of which explains nomenclature. A bibliography, an index of alternate characteristics, and a manufacturers' index in two parts, are included. The second part of the manufacturers index lists manufacturers of custom-made relays. This is a remarkable and valuable book for persons concerned with relays.

Jackson, Albert S. / Analog Computation / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. / 1960, printed, 652 pp, $13.50

The general-purpose electronic analog computer is the subject of this book which may serve as an introduction to those unfamiliar with the computer, and as a source of additional information to those in the field. In an introductory chapter basic concepts are discussed, followed by thirteen chapters with information on amplitude and time scale factors, algebraic matrix models, the solving of ordinary linear and nonlinear differential equations, basic analog computer components and digital techniques applied to analog computation. A chapter is devoted to the role of analog computation in Operations Research. Seven appendices and an index are included.

Kemeny, J. G., H. Mirkil, J. L. Snell, and G. L. Thompson / Finite Mathematical Structures / Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. / 1959, printed, 487 pp, $11.00

The purpose of this book is to present the subject matter of finite mathematics to those who have a good knowledge of calculus and who are interested in applications in the physical sciences. It is clearly and interestingly written. The seven chapters are: Compound Statements, Sets and Functions, Probability Theory, Elementary Linear Algebra, Convex Sets, Finite Markov Chains, and Continuous Probability Theory. Many modern developments are covered, with examples and exercises. An index is included.

Hyman, Charles / German-English Mathematics Dictionary / Interlanguage Dictionaries Pub. Corp., 227 West 17 St., New York 11, N. Y. / 1960, offset, 131 pp, cost ?

By listing recently coined German scientific expressions and words, and their English meanings, this dictionary will prove to be extremely helpful in understanding recent German-language papers on automation in particular, and mathematics in general. "The present work is intended as a supplement to, and not as a substitute for, a general German-English dictionary." More than 8500 entries are included, and in most cases, the definitions are limited to scientific meanings. In some cases, the editor has provided phrases or sentences demonstrating the use of the word. Erratum: the meaning of the abbreviation "m" (masculine) should be given in the table of abbreviations on page 6.

Electronic Data Processing — Subject Bibliography of Periodical Literature, 1959 / Lybrand, Ross Bros. & Montgomery Management Services, 2 Broadway, New York 4, N. Y. / 1960, offset, 49 pp, cost ?

Approximately 75 periodicals have been checked to compile this bibliography of articles of interest in the field of electronic data processing. The articles are classified according to subjects ranging from Accounts Payable to Transportation: no descriptions or summaries of articles are provided.

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NEW PATENTS

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THE following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the United States Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington 25, D.C., at a cost of 25 cents each.

March 29, 1960 (Cont'd.)

2,930,896 / Francois H. Raymond, Saint-Germain-en-Laye, Fr. / Societe d'Electronique et d'Automatisme, Courbevoie, Fr. / A binary coded information stores.

2,931,014 / Werner Buchholz and Munro K. Haynes, Poughkeepsie, N.Y. and Gordon E. Whitney, Derby, Colo. / I.B.M. Corp., New York, N.Y. / A magnetic core buffer storage and conversion system.

2,931,015 / Theodore H. Bonn and Joseph D. Lawrence, Jr., Phila., Pa. / Sperry Rand Corp., a corp. of Del. / A drive system for magnetic core memories.

2,931,016 / Theodore H. Bonn and Joseph D. Lawrence, Jr., Phila., Pa. / Sperry Rand Corp., a corp. of Del. / A drive system for magnetic core memories.

2,931,017 / Theodore H. Bonn and Joseph D. Lawrence, Jr., Phila., Pa. / Sperry Rand Corp., a corp. of Del. / A drive system for magnetic core memories.

2,931,023 / Edward A. Quade, San Jose, Calif. / I.B.M. Corp., New York, N.Y. / A digital position indicator.

2,931,024 / Charles B. Slack, Winchester, Mass. / Baird-Atomic, Inc., a corp. of Mass. / A device for analogue to digital conversion, and components thereof.

2,931,025 / Ralph C. Wolcott, Whitney Point, and Harry R. Lord, Endicott, N.Y. / I.B.M. Corp., New York, N.Y. / A data handling circuit.

April 5, 1960

2,931,571 / Cebern B. Trimble, Dayton, Ohio / The National Cash Register Co., Dayton, Ohio / A magnetic storage device of multiple totals.

2,931,572 / Gerhard Dirks, Frankfurt am Main, Germany / — / A decimal addersubtractor device utilizing magnetic recordings.

2,931,689 / Olin L. Dupy, West Los Angeles, Calif. / Magnasync Mfg. Co., Ltd., North Hollywood, Calif. / An automatic programming system and method for recording of control records.

2,931,691 / Daniel L. Curtis, Manhattan Beach, and Robert B. Larsen, Hawthorne, Calif. / Litton Ind., Inc., Beverly Hills, Calif. / A magnetic drum memory system.

2,931,919 / Jacob M. Sacks, Rolling Hills, Calif. / U.S.A. as represented by the Sec. of the Navy / A diode gate circuit.

2,932,006 / Marvin H. Glauberman, Medfield, Mass. / Laboratory for Electronics, Inc., Boston, Mass. / A symbol recognition system.

2,932,007 / Theo Hense, Wilhelmshaven, Germany / Olympia Werke A. G., Wilhelmshaven, Germany / A matrix storage register.

2,932,008 / George H. Hoberg, Drexel Hill, Pa. / Burroughs Corp., Detroit, Mich. / A matrix system.

2,932,009 / Esmond P. Wright and Joseph Rice, London, Eng. / International Standard Electric Corp., New York, N.Y. / An intelligence storage equipment.

2,932,010 / Rollin P. Mayer, Concord, Mass., Richard C. Jeffrey, Princeton, N.J. and Bennett Housman and Donald B. Thompson, Poughkeepsie, N.Y. / Research Corp., New York, N.Y. / A data storage system.

2,932,011 / Sidney N. Einhorn, Phila., and George G. Hoberg, Berwyn, Pa., John O. Paivinen, Menlo Park, Calif., and Richard C. Weise, Phila., Pa. / Burroughs Corp., Detroit, Mich. / A matrix selection apparatus.

April 12, 1960

2,932,449 / Harry G. Pisarchik, Endicott, N.Y. / I.B.M. Corp., New York, N.Y. / An integrating apparatus.

2,932,451 / Horace S. Beattie and Theodore L. Buley, Poughkeepsie, N.Y. / I.B.M. Corp., New York, N.Y. / A matrix storage accumulator system.

2,932,471 / William L. Exner, Santa Monica, and Alfred D. Scarbrough, Pasadena, Calif. / Hughes Aircraft Co., Culver City, Calif. / A broad bandwidth digital servo.

April 19, 1960

2,933,248 / Floyd G. Steele, La Jolla, Calif. / Digital Control Systems, Inc., La Jolla, Calif. / A high speed digital control system.

2,933,249 / Thomas J. Scuitto, Santa Monica, Calif. / General Dynamics Corp., Rochester, N.Y. / A digital function accumulator.

2,933,250 / Edward J. Petherick, Rowledge, near Franham, Eng. / I.B.M. Corp., New York, N.Y. / A digital computing engine.

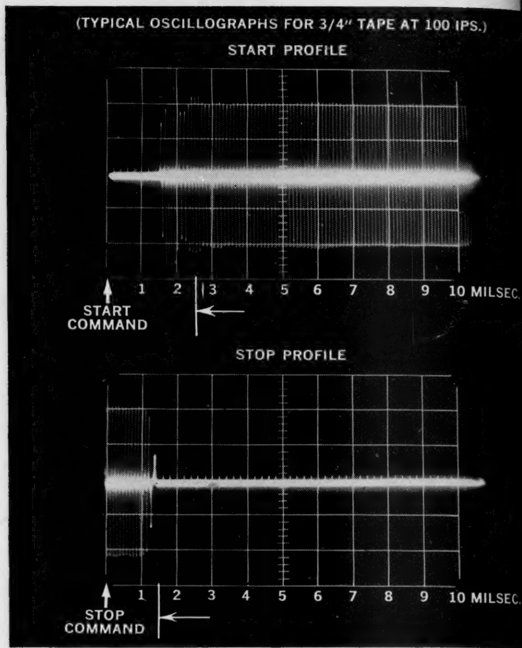
2,933,252 / Walter C. Lanning, Plainview, N.Y. / Sperry Rand Corp., a corp. of Del. / A binary adder-subtracter with command carry control.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

HERE'S PERFORMANCE...

FOR DIGITAL, MAGNETIC TAPE SYSTEMS



The Potter 906 II gives you the highest performance and reliability at savings up to 1 the cost of ordinary tape handlers. Potter has been given complete responsibility for ta sub-systems in some of the most widely sold computers. Potter's many years of co centrated specialization in tape system designs assures computer manufacturers of perform ance and dependability at costs that give them a competitive advantage in today's mark Computer users, too, are specifying Potter tape systems for lower rental costs, fewer servi problems, and less down time. The Potter 906 II Tape Handler is being specified by more a more manufacturers and computer users because of the kind of performance proven by t clean Start-Stop profiles above and because the 906 II offers such other advantages a ● Full forward-reverse cycling with 1" tape at 120 ips. ● Low skew tape guide. ● Hi density: 450,000 8-bit characters per second can be recorded on 1" ta by using the 906 II with the Potter Contiguous Double Transiti System. ● Transistorized control of all functions. ● Simplified packagi for easy maintenance. Write for detailed specifications, prices a delivery information on the 906 II and see proof that you get high performance and greater economy from a tape system specialist.

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